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BECKMAN COULTER™

SYNCHRON CX®
Clinical Systems

Diagnostics and Troubleshooting Guide

This manual is intended for use with
SYNCHRON CX®4/CX®7 DELTA
SYNCHRON CX4CE/CX7
SYNCHRON CX7 RTS/CX9 ALX
SYNCHRON CX®4 PRO/CX®5 PRO/CX®7 PRO/CX®9 PRO

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Section 1
GENERAL INFORMATION

This section provides general information for the use of the SYNCHRON CX4, CX3 and ISE module Diagnostics software routines. A detailed description of the software functions is given in Section Three, Diagnostic Functional Areas.

1.1 DIAGNOSTICS MAIN MENU

The SYNCHRON CX4, CX3, and ISE module Diagnostics software package resides on the hard disk. The following steps are required to access diagnostics from the operating system:

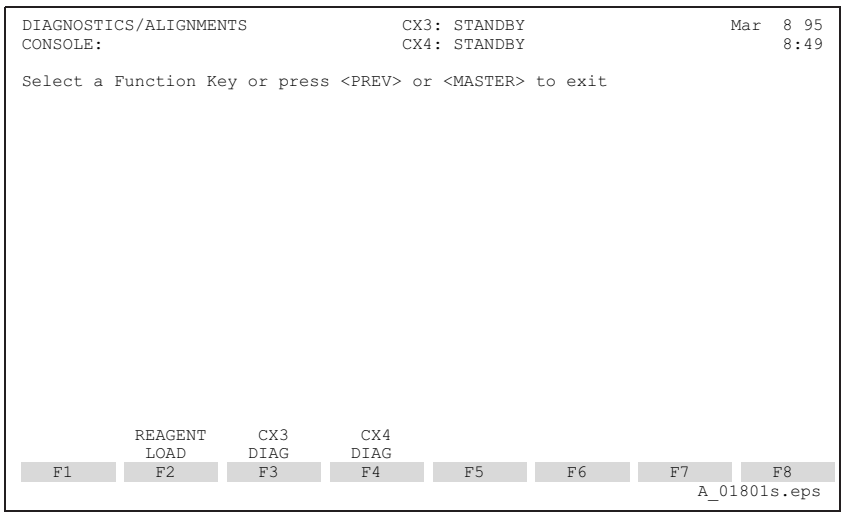
NOTE

CX3/ISE calibration will be lost upon entering Diagnostics.

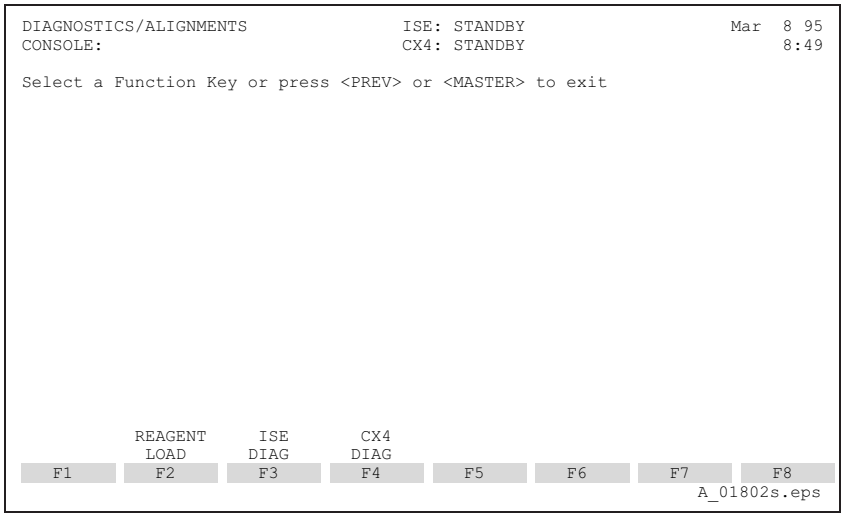
1. From MASTER Screen, press **F4 SPECIAL FUNCTION**.
2. Cursor and Select 3. Diagnostic/Alignment or press **3**. then **ENTER**. This will bring up the Diagnostics Entry Screen (Fig 1-1).
3. Press either **F3 CX3 DIAG**, **F3 ISE DIAG**, or **F4 CX4 DIAG** for the desired area of diagnostics. (Fig 1-2 and 1-3.)

NOTE

The diagnostic software for CX4 and/or CX3/ISE will initiate a brief boot process (approximately 2 to 3 minutes) after which the diagnostics MAIN MENU Screen for the selected area will be displayed. Once the initial boot process is over, the operator can easily switch from one diagnostic area to the other without waiting for repetitive boots. If **MASTER SCREEN** or **PREV SCREEN** is selected while in the Diagnostics Entry Screen a window will appear “EXITING THIS SCREEN WILL EXIT DIAGNOSTICS AND REQUIRES 10 MINUTES. DO YOU WISH TO EXIT DIAGNOSTICS (Y/N)”?. If **Y** is selected the operating software will be reloaded, thus requiring a complete boot process if it is necessary to return to diagnostics.

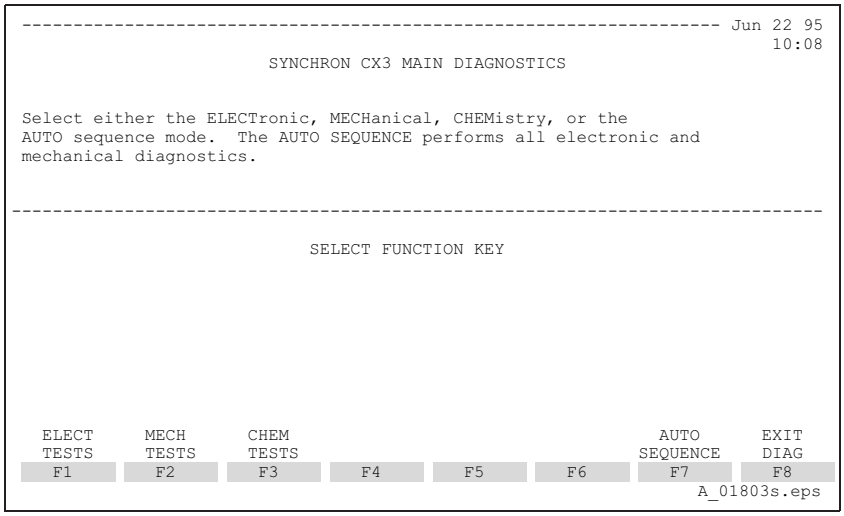


A

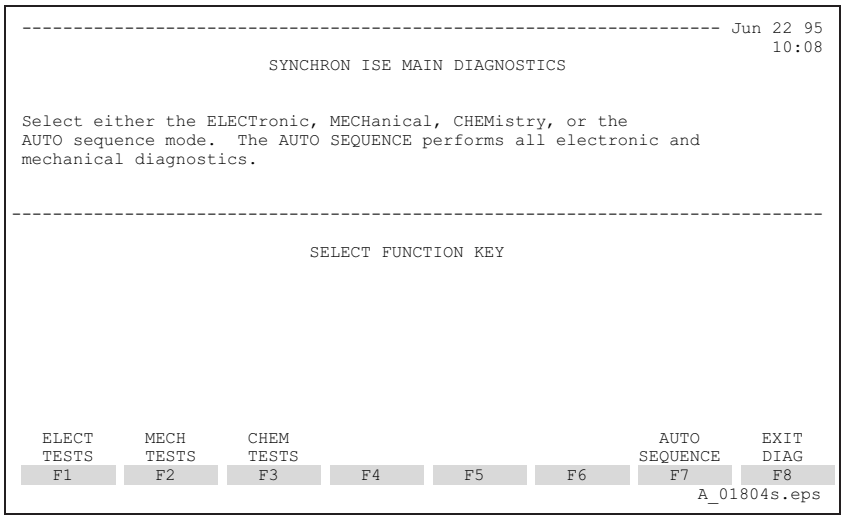


B

Figure 1-1. Diagnostics Entry Screens



A



B

Figure 1-2. CX3 and ISE Main Diagnostics Screen

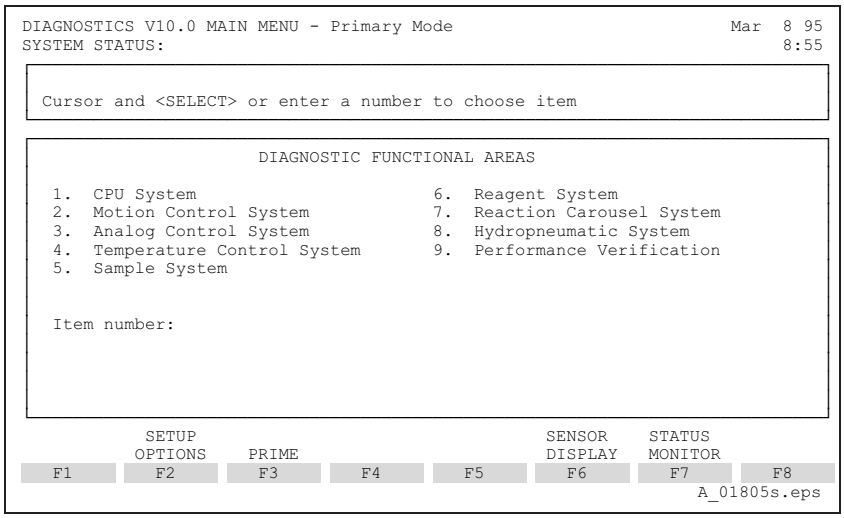


Figure 1-3. CX4 Main Diagnostics Screen

The available diagnostic routines are categorized into functional areas. There are nine (9) functional areas on the SYNCHRON CX4 and two (2) on the SYNCHRON CX3 and ISE modules covering all aspects of system hardware, software, and chemistry operation.

A functional area is a group of interrelated modules that perform a common task. As an example, one such functional area is the Sample System. The Sample System is comprised of the sample probe, sample mixer, sample carousel, and the sample autoloader. All of these modules work together to deliver the sample for chemistry analysis. Each of the individual modules have specific tests which determine if the module is performing properly. For example, proper operation of the sample probe module is verified by running the following associated tests: rotary motor, up/down motor, level sense test, and probe sensor checks.

This hierarchy of diagnostic testing exists for every functional area. Each of the functional areas may be selected for diagnostic operation from the diagnostics MAIN MENU Screen.

1.1.1 CX4 Setup Options

There are a variety of setup options by which the operator can set the desired level of testing. The operator can access these options by pressing **F2 SETUP OPTIONS** from the diagnostics MAIN MENU Screen.

1.1.1.1 CX4 Test Modes

There are three modes of operation in the diagnostic software: PRIMARY, EXTENDED, and ALIGNMENT (refer to Paragraph 1.2 for a detailed description of each mode). The following conventions are recommended when selecting the proper test mode:

1. PRIMARY Mode diagnostics should be run prior to EXTENDED Mode diagnostics.
2. Any failures encountered in PRIMARY Mode should be confirmed through EXTENDED Mode routines.
3. If all PRIMARY Mode tests pass, refer to Section Three, Diagnostic Functional Areas for the EXTENDED Mode test menu for additional tests not included in PRIMARY Mode testing.

1.1.1.2 CX4 Replicates

Replicates of one, five, ten or continuous are available for EXTENDED Mode operation. Replicate testing is useful when troubleshooting an intermittent malfunction. There are some tests in which the continuous mode is not applicable. In these cases, if the continuous mode is selected, it will default to one replicate for that particular test only.

1.1.1.3 CX4 Printout Results

The Printout Results option allows for automatic printing of the final test results. This option is available for EXTENDED Mode operation only. It is recommended that this option be set to YES as a precaution against losing test result data.

1.1.1.4 CX4 Printout Summary

The Printout Summary allows for automatic printing of the test summary and is available for EXTENDED Mode operation.

NOTE

The printout summary for PRIMARY Mode diagnostics is not operational in this software version even if the option is set to “YES.” The PRIMARY Mode Test Summary can be printed by using **PRINT SCREEN**, or by pressing **PAGE UP** or **PAGE DOWN**, which will scroll the test summary screen and concurrently generate a printout of the screen.

1.1.2 CX4 Reagent Load

CX4 reagents may be loaded by pressing **F2 REAGENT LOAD** from the Diagnostics Entry Screen. Diagnostic tests in the System Performance Verification functional area require test cartridges to be loaded on the reagent carousel. (Refer to the appropriate Operating Instructions manual for details.) CX3/ISE reagent load is not available from diagnostics at this time.

1.1.3 CX4 Sensor Display

Pressing **F6 SENSOR DISPLAY** shows the status of the sensors in the following functional areas: Sample System and Reagent System and Reaction System. Power to various motors may be removed and restored to manually verify sensor operation by cursoring to the desired module and pressing **SELECT**. The System will go through a HOME sequence and power will be automatically restored to all modules upon exiting the screen.

1.1.4 CX4 Status Monitor

Pressing **F7 STATUS MONITOR** displays information on the CX4 power supplies, temperature sensors, fluid volumes, DI water purity and air pressure on a real-time basis. This function is available for viewing in most diagnostic routines. Any value that is flashing on the operator's screen indicates an out-of-range condition.

1.2 CX4 TEST MODE

1.2.1 PRIMARY Mode

PRIMARY Mode operation automatically performs all tests within the selected functional area requiring no operator intervention. This mode of operation is the default mode when the diagnostics software is first invoked. At the completion of a PRIMARY Mode test, a TEST SUMMARY is displayed on the screen. If all tests passed, the statement "All Tests PASS" will appear next to the applicable module (remember, a functional area is made up of several related modules each having specific tests). If one or more tests failed, a complete listing of all tests performed and whether it passed or failed will appear under the module. It is recommended that any failed PRIMARY Mode test be confirmed through EXTENDED Mode operation.

By pressing **PRINT SCREEN** at the completion of a PRIMARY Mode test, a hard copy of the test summary will print. An example of a PRIMARY Mode routine is included below.

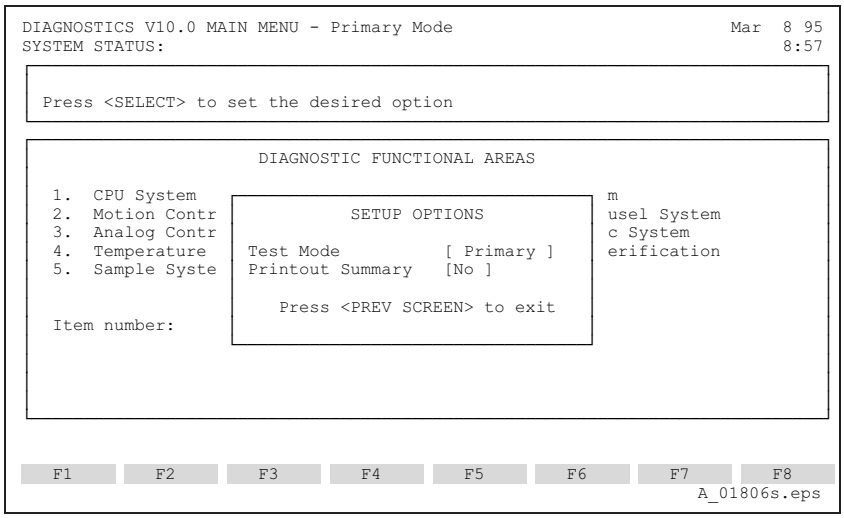


Figure 1-4. Setup options - Primary Mode - Printout Summary

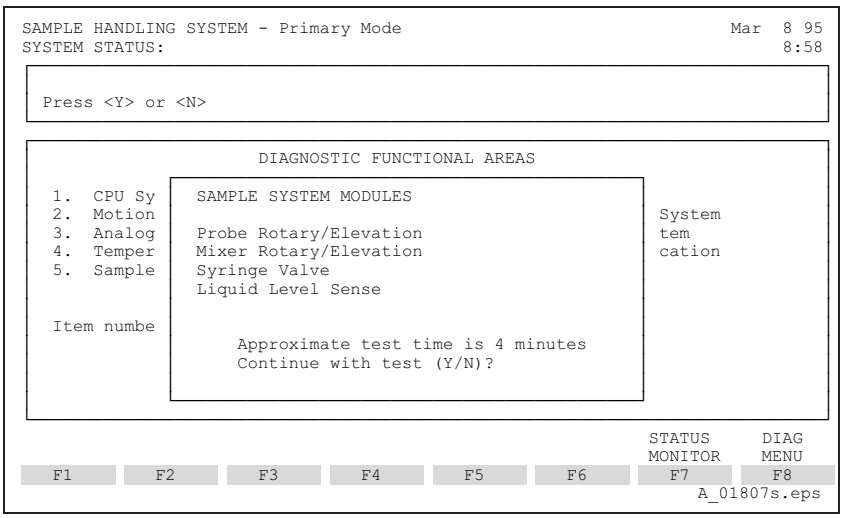


Figure 1-5. Sample System Module - Primary Mode

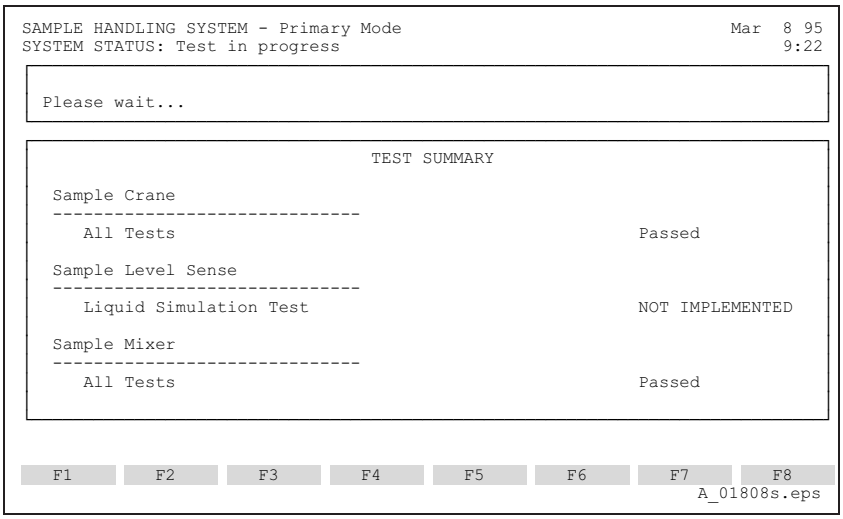


Figure 1-6. Test Summary - Primary Mode

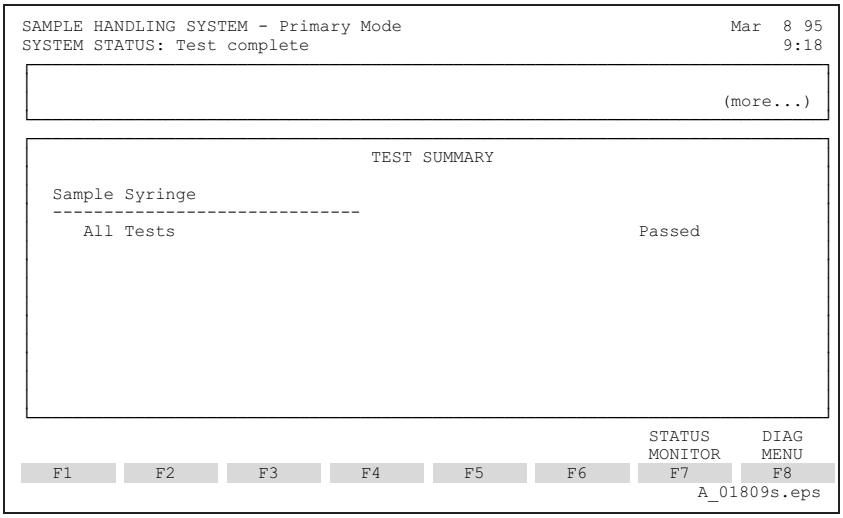


Figure 1-7. Test Summary - Primary Mode

1.2.2 EXTENDED Mode

EXTENDED Mode tests include all PRIMARY Mode tests in addition to other tests requiring some level of operator intervention. EXTENDED Mode diagnostics is used for confirming PRIMARY Mode test failures, performing additional tests not included in the PRIMARY Mode routines, and in some cases, performing fine adjustments. Unlike the PRIMARY Mode of operation which automatically performs ALL tests within a module, this operation mode allows for individual test selections to be made by the operator. To aid in diagnosing an intermittent problem, the operator may elect to perform test routines in replicates of five, ten, or continuous. An example of an EXTENDED Mode routine is included below.

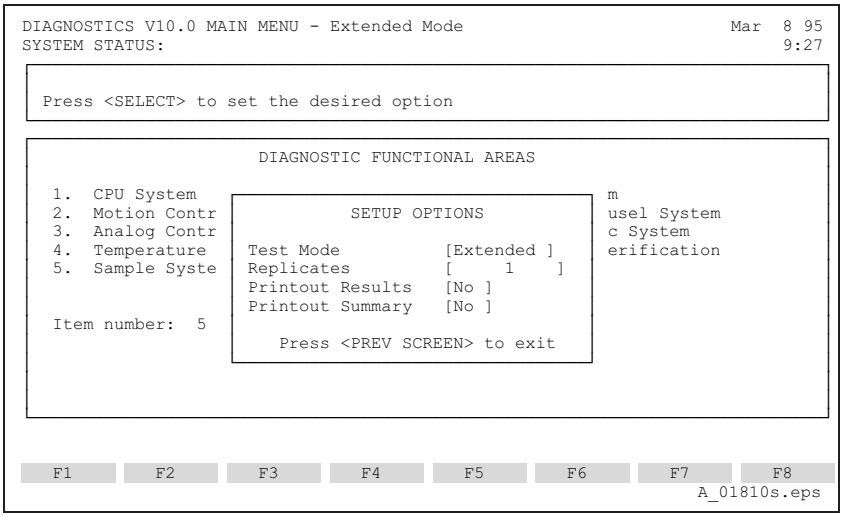


Figure 1-8. Setup Options - Extended Mode

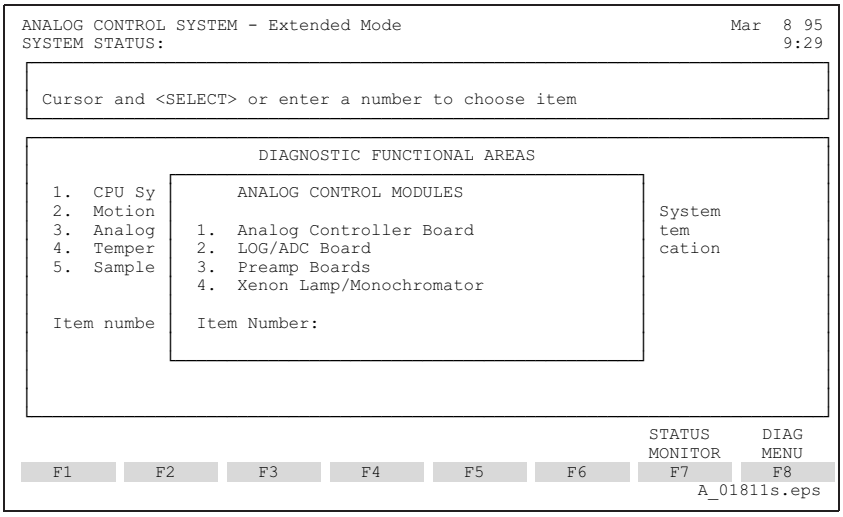


Figure 1-9. Analog Control Modules - Extended Mode

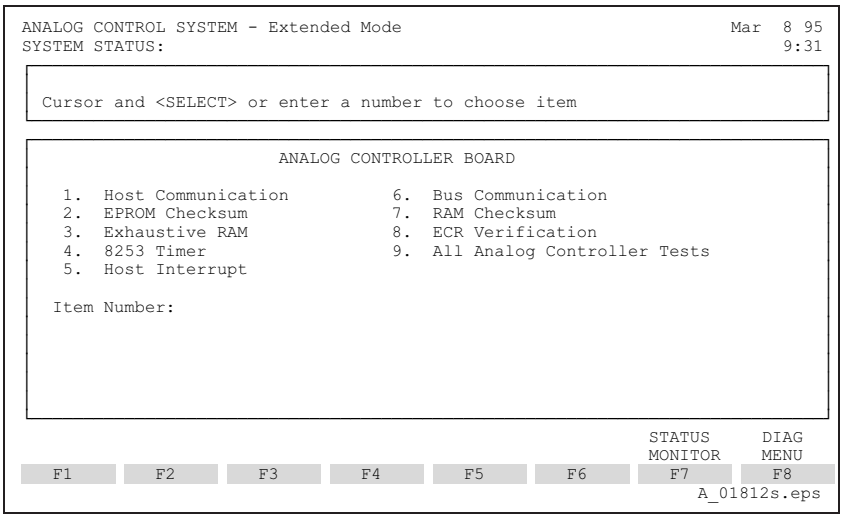


Figure 1-10. Analog Controller Board - Extended Mode

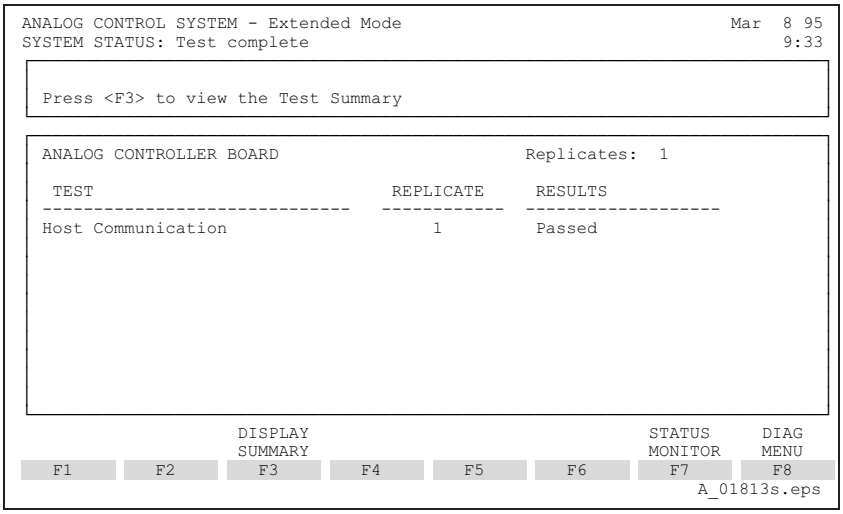


Figure 1-11. Communications Analog Control Board - Extended Mode

1.2.3 ALIGNMENT Mode

ALIGNMENT Mode operation allows for adjustment of the sample carousel, the reaction carousel and sensors, the reagent refrigerator, the sample and reagent probes and mixers, the syringe pumps, and the CX3/ISE sample probe. ALIGNMENT Mode procedures are step-by-step, on-screen instructions which use the system computer to aid the operator in properly adjusting the desired module. The following functional areas have ALIGNMENT Mode operation available:

Sample System
Reagent System
Analog Control
Reaction Carousel

CAUTION

Stepping through the Alignment Procedures could cause changes to the software alignment files, even if no adjustments are made. It is recommended that these procedures be exercised only if necessary.

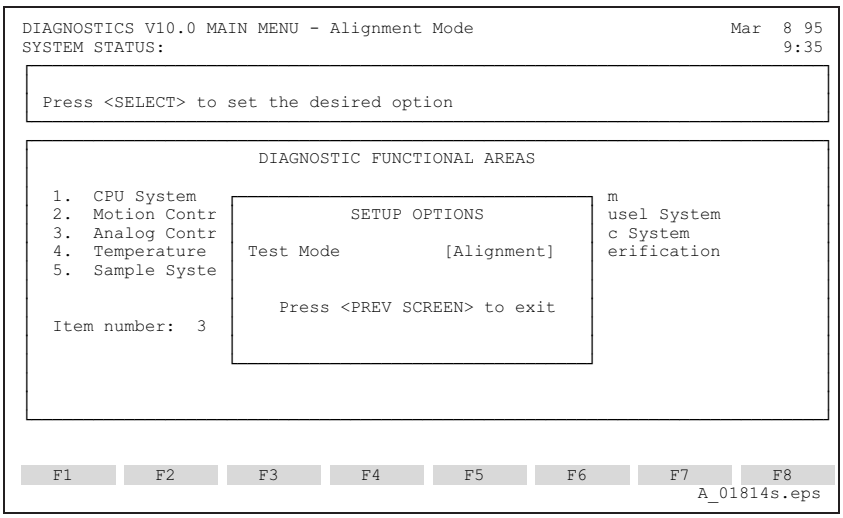


Figure 1-12. Setup Options - Alignment Mode

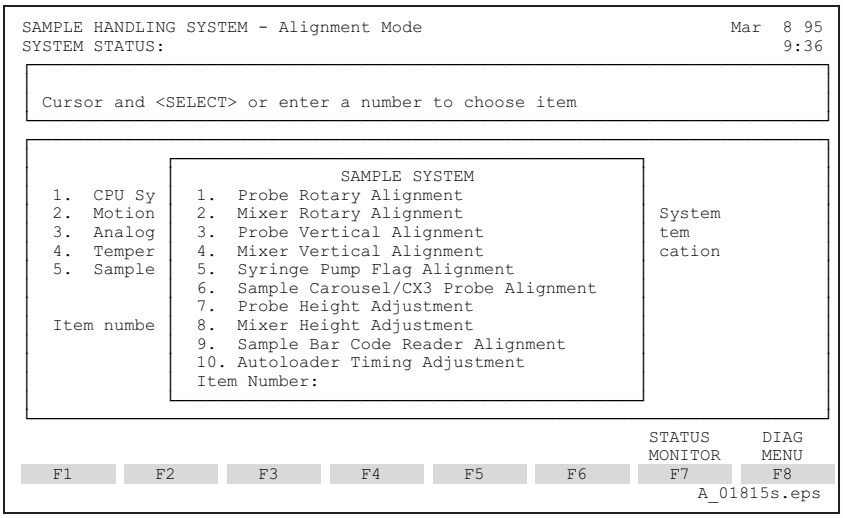


Figure 1-13. Sample System - Alignment Mode

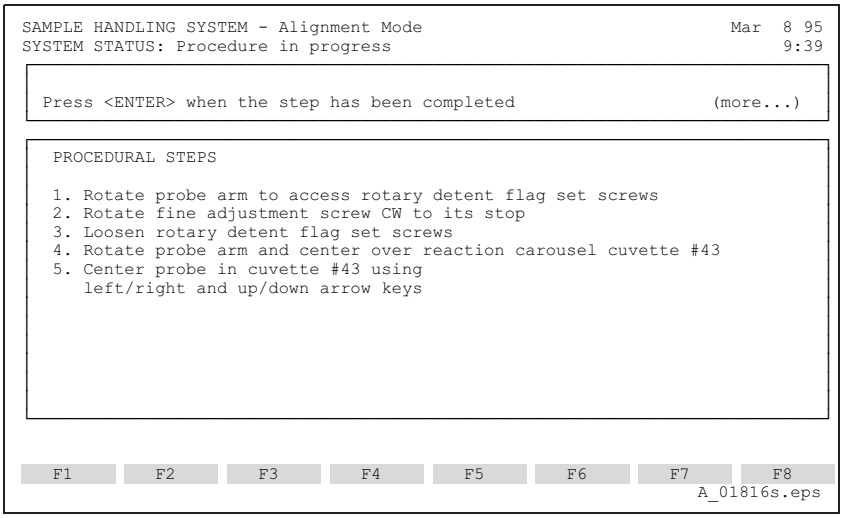


Figure 1-14. Procedural Steps - Alignment Mode

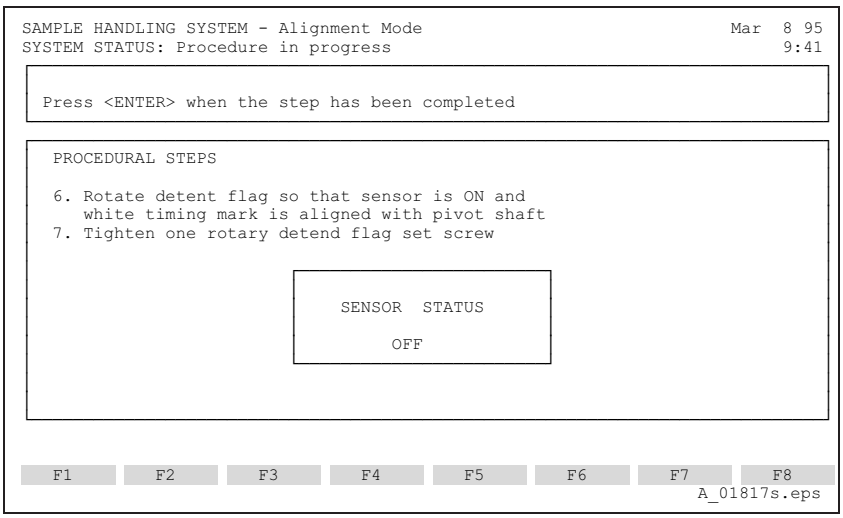


Figure 1-15. Procedural Steps - Alignment Mode

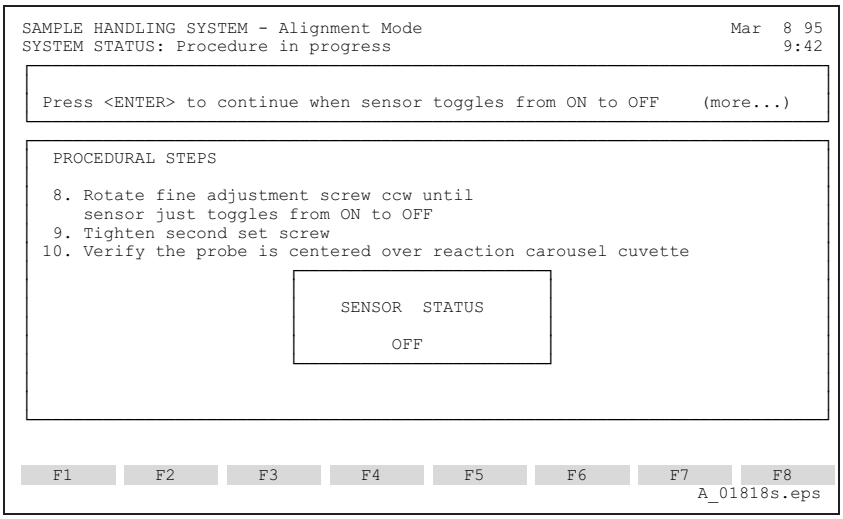


Figure 1-16. Procedural Steps - Alignment Mode

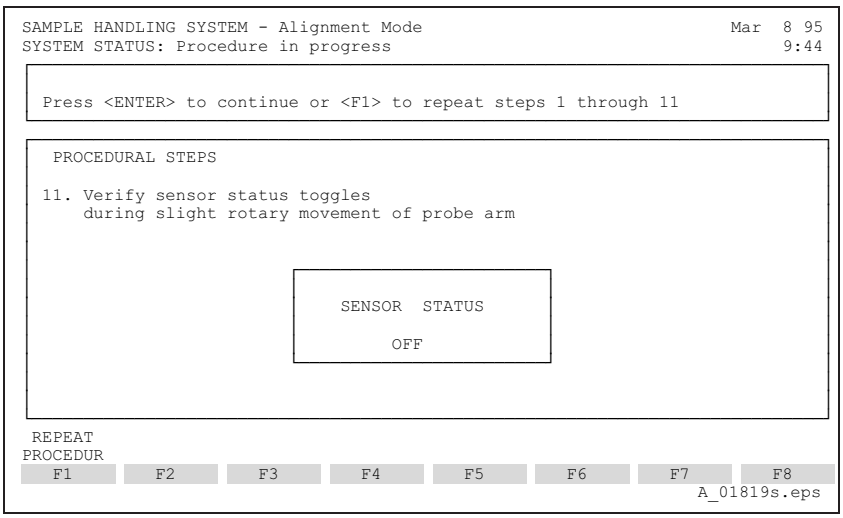


Figure 1-17. Procedural Steps - Alignment Mode

1.3 EXITING DIAGNOSTICS

Pressing **MASTER SCREEN** while in the Diagnostic Entry Screen will give the operator the option of returning to the operating software requiring a confirmatory response. A window appears with the message “EXITING THIS SCREEN WILL EXIT DIAGNOSTICS AND REQUIRES 10 MINUTES. DO YOU WISH TO EXIT DIAGNOSTICS (Y/N)?”

Pressing **Y** will begin the software boot sequence to return to the operating software. This will take approximately ten minutes before the MASTER Screen is initialized. Pressing **N** will return the operator to the diagnostics Entry Screen.

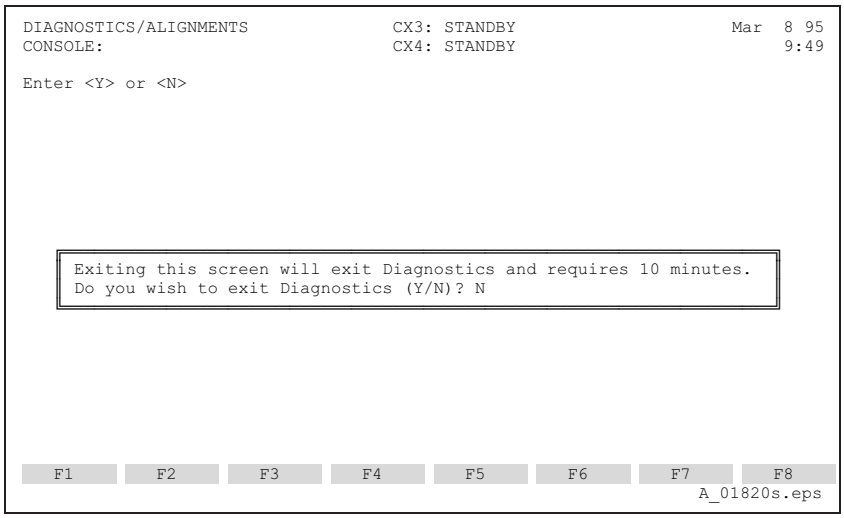


Figure 1-18. Procedural Steps - Alignment Mode

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Section 2
TROUBLESHOOTING

2.1 HARDWARE AND SOFTWARE ERROR CODES

System errors, which can be hardware or software in nature, will either generate an error window or appear on the first line of the message box informing the operator that a problem exists. An error window occurs if the problem was detected by the system while doing routine background diagnostic checks; for example, a sensor detected the reaction carousel was outside allowable specifications. An error in the message box occurs if the problem exists in response to the operator performing a direct action on the system; for example, **START** was pressed while the system was not in a standby condition. In either situation, the user is informed of the problem and in the event the resolution is not apparent, the following troubleshooting guide is to be used as reference. If an error message not listed in this directory appears, call your local Beckman representative.*

2.1.1 Error Messages Generated While Running (in Alphabetical Order)

2.1.1.1 CX4 ERROR MESSAGES

MESSAGE:	AIR PRESSURE NOT IN RANGE
CAUSE:	The air pressure registered by the sensors is not within the instrument range.
CORRECTIVE ACTION:	1. Check pneumatic lines and bottle caps for air leaks. 2. Verify the air pressure level from the gauge on the compressor. 3. If the compressor gauge registers an air pressure that is within the instrument limits, then the sensor is suspected. Call your local Beckman representative*.
MESSAGE:	ANALOG CONTROL SENSOR ERROR
CAUSE:	One of the reaction carousel or sample carousel sensors was not tripped when expected. This message will be generated along with a reaction carousel or sample carousel motion error. If the message appears by itself, perform the following:
CORRECTIVE ACTION:	1. View and print Event Log #4. 2. Call your local Beckman representative*.

* Contact the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

MESSAGE: CUVETTE FAILED WATER BLANK TEST

CAUSE: The cuvette "cleanliness check" performed during the wash cycle detected a water absorbance that is out of range on a particular cuvette.

CORRECTIVE ACTION:

1. Press **PREV SCREEN**
2. If several cuvettes fail the water blank test, perform CX4 CUVETTE WASH (SPEC FUNC 4, option 6 MAINTENANCE, option 2).
3. If cuvettes continue to fail, perform FLASH POWER SUPPLY ADJUSTMENT, Paragraph 3.3.7.

MESSAGE: CX4 DILUTE WASH TOO LOW

CAUSE: Both of the CX4 wash bottle float switches detected low wash solution volume when **START** was pressed. In order for the system to START, at least one wash bottle must register FULL.

CORRECTIVE ACTION:

1. Fill wash bottles through the PRIME function.
2. Perform diagnostics, Paragraph 3.8.2.1.

MESSAGE: DI WATER OUT OF LIMITS

CAUSE: The DI water purity sensor located at the exit port of the water reservoir has detected water with less than 1 megaohm resistance entering the system.

CORRECTIVE ACTION:

1. Prime the internal probe wash several times to flush the system.
2. Verify power connections on the water sensor. (Refer to Paragraph 3.4.4.2 in the Operating Instructions manual.)
3. Verify water purity.
4. Turn off DI water supply to the system and call your local Beckman representative*.

MESSAGE: FATAL ERROR : ANALOG COMMUNICATIONS

CAUSE: A fatal error has occurred during initialization of the Analog Control system.

CORRECTIVE ACTION:

1. Reboot the system through System Idle.
2. Refer to Event Log #4 for specific failure:

EVENT LOG ENTRY:	**DIAGNOSTIC PROCEDURE:**
Flash Power File Not Found:	Flash Power Supply, Paragraph 3.3.7
Flash Delay File Not Found:	Flash Delay, Paragraph 3.3.6
All other entries:	Analog Control System, Paragraph 3.3

MESSAGE: FATAL ERROR : CALIBRATOR DATA MANAGER

CAUSE: A fatal error has occurred corrupting Calibration database.

CORRECTIVE ACTION:

1. Reboot the system through System Idle.
2. Call your local Beckman representative*.

MESSAGE:	FATAL ERROR : CHEMISTRY DATA MANAGER
CAUSE:	A fatal error has occurred corrupting Chemistry database.
CORRECTIVE ACTION:	1. Reload operating software disk and restore backup diskette (Refer to Section 5.1 of the Operating Instructions - P/N 015-248408). 2. Call your local Beckman representative*.
MESSAGE:	FATAL ERROR: REAGENT DATA MANAGER
CAUSE:	A fatal error has occurred corrupting Reagent database.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Call your local Beckman representative*.
MESSAGE:	FATAL ERROR: RESULT DATA MANAGER
CAUSE:	A fatal error has occurred corrupting Results database.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Call your local Beckman representative*.
MESSAGE:	FATAL ERROR: SAMPLE DATA MANAGER
CAUSE:	A fatal error has occurred corrupting Sample database.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Call your local Beckman representative*.
MESSAGE:	FATAL ERROR: SECTOR DATA MANAGER
CAUSE:	A fatal error has occurred corrupting Sector database.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Call your local Beckman representative*.
MESSAGE:	FATAL MMC ERROR: MMC DETECTED NO COMM FROM HOST
CAUSE:	A fatal error occurred when the Master Motion Controller Board failed to receive a message from the CPU.
CORRECTIVE ACTION:	1. Reboot the system through System Idle. 2. Perform Motion Control diagnostics, Paragraph 3.2. 3. Perform CPU diagnostics, Paragraph 3.1.

MESSAGE:	FATAL MMC ERROR: TIMEOUT READING MSC
CAUSE:	A fatal error occurred when the Master Motion Controller Board expected to read a Motor System Controller response within a specific time frame.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Perform Motion Control diagnostics, Paragraph 3.2.
MESSAGE:	FATAL MMC ERROR: TIMEOUT WRITING MSC
CAUSE:	A fatal error occurred when the Master Motion Controller Board attempted to write to the Motor System Controller Boards within a specific time frame.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Refer to Event Log #4. 3. Perform Motion Control diagnostics, Paragraph 3.2.
MESSAGE:	LOAD WAS REQUESTED BUT NO SECTOR WAS LOADED
CAUSE:	The LOAD button was pressed, but no sector was recognized.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Verify that no sector was loaded 3. Verify sector bar code label placement 4. Perform diagnostics Paragraph 3.5 (sector reader test)
MESSAGE:	MOTION ERROR - AUTOLOADER UP
CAUSE:	A motion error occurred when the Autoloader attempted to rise.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform Autoloader Rotary Alignment, Paragraph 4.1. 3. Perform diagnostics, Paragraph 3.5.
MESSAGE:	MOTION ERROR - AUTOLOADER UP/DOWN ERROR
CAUSE:	A motion error occurred when the Autoloader attempted to rise.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform Autoloader Rotary Alignment, Paragraph 4.1. 3. Perform diagnostics, Paragraph 3.8.

MESSAGE:	MOTION ERROR - CHECKSUM ERROR IN MSC DOWNLOAD
CAUSE:	When data was being downloaded to the Motion System Controller boards, a checksum error occurred.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Perform Motion System Controller Boards diagnostics Paragraph 3.2.
MESSAGE:	MOTION ERROR - CUVETTE VACUUM
CAUSE:	A motion error occurred when the cuvette vacuum valve attempted to operate.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Perform Hydropneumatic CUVETTE WASH TEST Paragraph 3.8.2.5.
MESSAGE:	MOTION ERROR - CUVETTE WASH
CAUSE:	A motion error occurred when the cuvette wash station attempted to move.
CORRECTIVE ACTION:	1. Prime the Cuvette Wash lines and observe the orientation of the cuvette wash station to verify proper alignment. 2. Perform Wash Station Alignment, Paragraph 3.7.5.
MESSAGE:	MOTION ERROR - DI MIXER VALVE
CAUSE:	A motion error occurred with the DI mixer valve when the system was filling the wash solution bottles.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Fill the wash bottles through the PRIME function. 3. Perform Hydropneumatic EXTERNAL PROBE WASH TEST Paragraph 3.8.
MESSAGE:	MOTION ERROR - DI WATER TO SYSTEM
CAUSE:	A motion error occurred with the valve that controls the delivery of DI water to the system.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Call your local Beckman representative*.
MESSAGE:	MOTION ERROR - DI WATER TO CUVETTE WASH
CAUSE:	A motion error occurred with the valve that controls the delivery of DI water to the cuvette wash station.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Perform Hydropneumatic CUVETTE WASH TEST Paragraph 3.8.2.

MESSAGE:	MOTION ERROR - MIX BOTTLE 1
CAUSE:	A motion error occurred when the system attempted to fill wash bottle #1.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Fill the wash bottles through the PRIME function. 3. Perform the HYDROPNEUMATICS MIX WASH SOLUTION TEST, Paragraph 3.8.2.
MESSAGE:	MOTION ERROR - MIX BOTTLE 2
CAUSE:	A motion error occurred when the system attempted to fill wash bottle #2.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Fill the wash bottles through the PRIME function. 3. Perform the HYDROPNEUMATICS MIX WASH SOLUTION TEST, Paragraph 3.8.2.
MESSAGE:	MOTION ERROR - MSC PROCESSOR OR EPROM FAILURE
CAUSE:	One of the five MSC (Motion System Controller) boards failed an internal check.
CORRECTIVE ACTION:	1. Reboot system through System Idle. 2. Perform MSC diagnostics, Paragraph 3.2.
MESSAGE:	MOTION ERROR: NO GOLDEN PHASE ON REACTION CAROUSEL
CAUSE:	When the reaction carousel attempted to rotate, it did not find the Golden Phase alignment file.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Press the **HOME** key. 3. Perform sample carousel flag alignment Paragraph 3.5.13.
MESSAGE:	MOTION ERROR: NO GOLDEN PHASE ON REAGENT
CAUSE:	When the reagent carousel attempted to rotate, it did not find the Golden Phase alignment file.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Press the **HOME** key 3. Perform reagent carousel flag alignment Paragraph 3.6.8.

MESSAGE:	MOTION ERROR: NO GOLDEN PHASE ON SAMPLE
CAUSE:	When the sample carousel attempted to rotate, it did not find the Golden Phase alignment file.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Press the **HOME** key. 3. Perform sample carousel flag alignment Paragraph 3.5.13.
MESSAGE:	MOTION ERROR: NO HOME ON REACTION CAROUSEL
CAUSE:	The reaction carousel could not locate the HOME position.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Press the **HOME** key. 3. Perform reaction carousel flag alignment Paragraph 3.7.4.
MESSAGE:	MOTION ERROR: NO HOME ON REAGENT
CAUSE:	The reagent carousel could not locate the HOME position.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Press the **HOME** key. 3. Perform reagent carousel flag alignment Paragraph 3.6.8.
MESSAGE:	MOTION ERROR: NO HOME ON SAMPLE
CAUSE:	The sample carousel could not locate the HOME position.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Press the **HOME** key. 3. Perform sample carousel flag alignment Paragraph 3.5.13.
MESSAGE:	MOTION ERROR - REACTION CAROUSEL
CAUSE:	A motion error occurred when the reaction carousel attempted to rotate but was prevented.
CORRECTIVE ACTION:	1. Press the **HOME** key and inspect reaction carousel rotation to determine the origin of the motion error. 2. Press the **HOME** key and examine the cuvette retaining ring for even rotation. 3. Perform Reaction Carousel Alignment, Paragraph 3.7.4.

MESSAGE:	MOTION ERROR - REAGENT CAROUSEL
CAUSE:	A motion error occurred when the reagent carousel attempted to rotate and was unable to locate the proper position.
CORRECTIVE ACTION:	1. Press the **HOME** key. 2. Perform Reagent Carousel Alignment, Paragraph 3.6.8.
MESSAGE:	MOTION ERROR - REAGENT DOOR IS OPEN!
CAUSE:	A motion error occurred when the system attempted to rotate the reagent refrigerator and the reagent door was not closed.
CORRECTIVE ACTION:	1. Ensure the door is completely closed and the door latch is locked. 2. Exit reagent load and press the **HOME** key. 3. The reagent door latch or the sensor is suspected, call your local Beckman representative*.
MESSAGE:	MOTION ERROR - REAGENT MIXER ROTATE
CAUSE:	A motion error occurred when the reagent mixer attempted to rotate to a specified position.
CORRECTIVE ACTION:	1. Press the **HOME** key to home the system. 2. Verify no foreign articles are in the field of rotation of the reagent mixer causing an interference with the motion. 3. Perform diagnostics, Paragraph 3.6.3.
MESSAGE:	MOTION ERROR - REAGENT MIXER SPIN
CAUSE:	A motion error occurred when the reagent mixer attempted to spin.
CORRECTIVE ACTION:	1. Verify reagent mixer cable connections. 2. Perform diagnostics, Paragraph 3.6.3.
MESSAGE:	MOTION ERROR - REAGENT MIXER UP/DOWN
CAUSE:	A motion error occurred when the reagent mixer attempted to move up or down.
CORRECTIVE ACTION:	1. Press the **HOME** key to home the system and verify the up-down motion. 2. Ensure no foreign articles are in the field of motion (i.e., covers and cables). 3. Perform diagnostics, Paragraph 3.6.3.
MESSAGE:	MOTION ERROR - REAGENT PROBE AIR STRIP
CAUSE:	A motion error occurred with the air strip valve servicing the reagent probe.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Perform Hydropneumatic PROBE AIR STRIP TEST Paragraph 3.8.3.

MESSAGE: MOTION ERROR - REAGENT PROBE ROTATE

CAUSE: A motion error occurred when the reagent probe attempted to rotate to a specified position.

CORRECTIVE ACTION:

1. Press the **HOME** key to home the system.
2. Verify no foreign articles are in the field of rotation of the reagent probe causing an interference with the motion.
3. Perform diagnostics, Paragraph 3.6.2.

MESSAGE: MOTION ERROR - REAGENT PROBE UP/DOWN

CAUSE: A motion error occurred when the reagent mixer attempted to move up or down.

CORRECTIVE ACTION:

1. Press the **HOME** key to home the system and verify free up-down motion.
2. Verify no foreign articles are in the field of movement of the reagent probe causing an interference with the motion (i.e., covers and cables).
3. Perform diagnostics, Paragraph 3.6.2.

MESSAGE: MOTION ERROR - REAGENT PROBE WASH

CAUSE: A motion error occurred when the system attempted to turn on the reagent probe wash valve during a wash cycle.

CORRECTIVE ACTION:

1. Press the **PREV SCREEN** key.
2. Prime both the External wash and the Internal wash through the PRIME function.
3. Perform Hydropneumatic INTERNAL PROBE/SCRUB BUBBLE TEST, Paragraph 3.8.2.

MESSAGE: MOTION ERROR - REAGENT PUMP

CAUSE: A motion error occurred when the reagent syringe pump attempted to move to a specified position.

CORRECTIVE ACTION:

1. If maintenance was performed just prior to this error:
   (a) Examine the seating of the syringe plunger in the white rubber coupling and the coupling nut.
2. If no maintenance was performed:
   (a) Press the **HOME** key to home the system.
   (b) Verify no foreign articles are in the field of movement of the reagent syringe pump causing an interference with the motion (i.e., covers and cables).
   (c) Perform diagnostics, Paragraph 3.6.

MESSAGE:	MOTION ERROR - REAGENT VALVE
CAUSE:	A motion error occurred when the reagent valve, responsible for the control of the probe rinse solution flow, failed to turn on or off.
CORRECTIVE ACTION:	1. Prime the internal probe wash to confirm operation. 2. Verify valve power connections. (Refer to the figure in Paragraph 3.8.2.3.) 3. Perform Hydropneumatic diagnostics, Paragraph 3.8.2.4.
MESSAGE:	MOTION ERROR - SAMPLE CAROUSEL
CAUSE:	A motion error occurred when the sample carousel attempted to rotate to a specified position.
CORRECTIVE ACTION:	1. Press the **HOME** key to home the system and verify free rotation of the sample carousel. 2. Perform diagnostics, Paragraph 3.5.4.
MESSAGE:	MOTION ERROR - SAMPLE MIXER ROTATE
CAUSE:	A motion error occurred when the sample mixer attempted to rotate to a specified position.
CORRECTIVE ACTION:	1. Press the **HOME** key when in STANDBY. 2. Verify no foreign articles are in the field of rotation of the reagent mixer causing an interference with the motion. 3. Perform diagnostics, Paragraph 3.5.3.
MESSAGE:	MOTION ERROR - SAMPLE MIXER SPIN
CAUSE:	A motion error occurred when the sample mixer attempted to spin.
CORRECTIVE ACTION:	1. Press the **HOME** key when in STANDBY. 2. Verify sample mixer cable connections. 3. Perform diagnostics, Paragraph 3.5.3.
MESSAGE:	MOTION ERROR - SAMPLE MIXER UP/DOWN
CAUSE:	A motion error occurred when the sample mixer attempted to move up or down.
CORRECTIVE ACTION:	1. Press the **HOME** key when in STANDBY. 2. Verify no foreign articles are in the field of motion of the sample mixer causing an interference with the motion. 3. Perform diagnostics, Paragraph 3.5.3.

MESSAGE:	MOTION ERROR - SAMPLE PROBE AIR STRIP
CAUSE:	A motion error occurred when the sample probe air strip valve, responsible for the addition of air to the sample probe wash station, failed to turn on or off.
CORRECTIVE ACTION:	1. Press the **HOME** key when in STANDBY. 2. Verify valve power connections. (Refer to the figure in Paragraph 3.8.2.3.) 3. Perform diagnostics, Paragraph 3.8.3.2.
MESSAGE:	MOTION ERROR - SAMPLE PROBE ROTATE
CAUSE:	A motion error occurred when the sample probe attempted to rotate to a specified position.
CORRECTIVE ACTION:	1. Press the **HOME** key when in STANDBY. 2. Verify no foreign articles are in the field of rotation of the sample probe causing an interference with the motion. 3. Perform diagnostics, Paragraph 3.5.2.
MESSAGE:	MOTION ERROR - SAMPLE PROBE UP/DOWN
CAUSE:	A motion error occurred when the sample probe attempted to move up or down.
CORRECTIVE ACTION:	1. Press the **HOME** key when in STANDBY and verify probe movement. 2. Verify no foreign articles are in the field of movement of the sample probe pump causing an interference with the motion (i.e., covers or cables). 3. Perform diagnostics, Paragraph 3.5.2.
MESSAGE:	MOTION ERROR - SAMPLE PROBE WASH
CAUSE:	A motion error occurred when the sample probe wash valve attempted to turn on.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Prime both the External wash and the Internal wash through the PRIME function. 3. Perform Hydropneumatic EXTERNAL PROBE WASH TEST Paragraph 3.8.2.

MESSAGE: MOTION ERROR - SAMPLE PUMP

CAUSE: A motion error occurred when the sample syringe pump attempted to move to a specified position.

CORRECTIVE ACTION:

1. If maintenance was performed just prior to the error code:
   (a) Verify the seating of the syringe plunger in the white rubber couplings and the coupling nut.
2. If no maintenance was performed:
   (a) Press the **HOME** key.
   (b) Verify no foreign articles are in the field of movement of the sample syringe pump causing an interference with the motion (i.e., covers and cables).
   (c) Perform diagnostics, Paragraph 3.5.11.

MESSAGE: MOTION ERROR - SAMPLE VALVE

CAUSE: A motion error occurred when the sample valve, responsible for the control of the DI water flow through the sample probe wash station, failed to turn on or off.

CORRECTIVE ACTION:

1. Prime the internal probe wash to confirm operation.
2. Verify valve power connections. (Refer to the figure in Paragraph 3.8.2.3.)
3. Perform Hydropneumatic diagnostics, Paragraph 3.8.2.4.

MESSAGE: MOTION ERROR - SUMP PUMP

CAUSE: A motion error occurred when the sump pump attempted to turn on.

CORRECTIVE ACTION:

1. Press **PREV SCREEN**.
2. Turn on the Drain Pump through the PRIME function.
3. Perform the HYDROPNEUMATIC SUMP PUMP TEST, Paragraph 3.8.4.

MESSAGE: MOTION ERROR - VACUUM RESERVOIR

CAUSE: A motion error occurred when the vacuum reservoir attempted to drain.

CORRECTIVE ACTION:

1. Press the **PREV SCREEN** key.
2. Activate the drain pump through the PRIME function.
3. Perform Hydropneumatic COMPRESSOR/VACUUM PUMP TEST, Paragraph 3.8.3.

MESSAGE:	MOTION ERROR - WASH MIXER VALVE
CAUSE:	A motion error occurred when the system attempted to fill either of the wash bottles.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Fill the wash bottles through the PRIME function. 3. Perform the HYDROPNEUMATICS MIX WASH SOLUTION TEST, paragraph 3.8.2.
MESSAGE:	MOTION ERROR - WASH TO CUVETTE WASH
CAUSE:	A motion error occurred with the valve that controls the delivery of wash solution to the cuvette wash station.
CORRECTIVE ACTION:	1. Press the **PREV SCREEN** key. 2. Perform Hydropneumatic CUVETTE WASH TEST Paragraph 3.8.2.
MESSAGE:	MOTION SYSTEM REQUIRES HOMING
CAUSE:	When the START key was pressed, the system determined that the hardware assemblies are not at HOME.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Press **HOME**.
MESSAGE:	MSC WAS DEAD AT INITIALIZATION
CAUSE:	One of the five motion system controller boards did not respond during initialization.
CORRECTIVE ACTION:	1. Perform diagnostics, Paragraph 3.2.3.
MESSAGE:	PELTIER FAILURE
CAUSE:	The reagent refrigerator has become disabled.
CORRECTIVE ACTION:	1. Reboot the system through System Idle. 2. Call your local Beckman representative*.
MESSAGE:	POWER SUPPLY FAILURE: CX4
CAUSE:	The output voltage on the power supply is out of specification.
CORRECTIVE ACTION:	1. View the STATUS MONITOR to determine which power supply is experiencing the failure. 2. View the power supply operation lamps on the front panel next to the disk drive to confirm power supply failure. 3. Call your local Beckman representative*.

MESSAGE: REAGENT LEVEL SENSE ERROR. CHECK REAGENT STATUS SCREEN FOR LOCATION

CAUSE: While loading a reagent cartridge, either a motion error occurred or an unexpected reagent volume was detected by the reagent probe.

CORRECTIVE ACTION:

1. Refer to REAGENT STATUS Screen to determine the reagent cartridge the error occurred on.
2. Remove the reagent cartridge in question and verify reagent volume in all applicable compartments and inspect for the presence of a bubble in the neck of the compartments.
3. If adequate reagent levels are present in all applicable compartments, reload cartridge. If one or more compartments have inadequate reagent levels, load a new cartridge.
4. Perform Probe Height Adjustment procedure, Paragraph 3.6.10.
5. The reagent level sensor is suspected, call your local Beckman representative*.

MESSAGE: REAGENT NOT DETECTED AT SAMPLE INJECT

CAUSE: The sample probe did not detect reagent in the cuvette at sample inject. The cuvette may be broken or no reagent may have been dispensed into the cuvette.

CORRECTIVE ACTION:

1. View Reagent Status to determine reagent cartridge at fault. Unload reagent cartridge and inspect for bubbles. Remove the bubbles and reload, or load a fresh cartridge.
2. If the reagent cartridge is not at fault, a broken cuvette is suspected. (Refer to Paragraph 4.5 for instructions on reaction carousel removal and inspect for a broken cuvette.)
3. Verify Bubble Generator operation. Perform diagnostics, Paragraph 3.8.2.4.

MESSAGE: SAMPLE NOT DETECTED

CAUSE: The sample probe did not find sample in the sample cup or tube when it expected sample to be present.

CORRECTIVE ACTION:

1. Press the **PREV SCREEN** key.
2. Perform the Sample System LEVEL SENSE test, Paragraph 3.5.2.

MESSAGE: SOFTWARE ERROR DETECTED

CAUSE: An internal error occurred with the operating software.

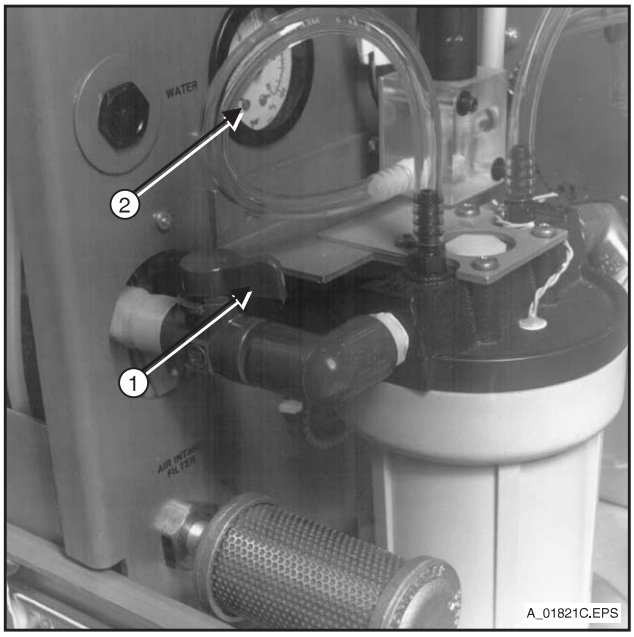
CORRECTIVE ACTION:

1. Reboot the system through System Idle.
2. Call your local Beckman representative*.

MESSAGE:	STAT LOAD WAS REQUESTED, BUT NO SECTOR WAS LOADED
CAUSE:	The STAT LOAD key was pressed, but the sector reader did not recognize a sector loaded.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Verify that no sector was loaded. 3. If a sector was loaded and not recognized, verify sector barcode label placement. 4. Perform diagnostics Paragraph 3.5.4 (sector reader test)
MESSAGE:	TEMPERATURE CONTROL FAILURE
CAUSE:	The temperature control system detected a temperature that is out of operating range. This message will occur when the system is first booted.
CORRECTIVE ACTION:	1. View the STATUS MONITOR to determine the module that is out of temperature control. 2. Perform diagnostics, Paragraph 3.4.
MESSAGE:	VACUUM LIQUID TRAP TOO HIGH
CAUSE:	The fluid level sensor detected too much fluid in the vacuum liquid trap.
CORRECTIVE ACTION:	1. Drain the vacuum liquid trap by turning on sump (drain) pump. (Refer to the PRIME Screen from the F4 SPECIAL FUNCTION key on the MASTER Screen.) 2. Perform Hydropneumatic diagnostics, Paragraphs 3.8.4.1. and 3.8.4.2.
MESSAGE:	VACUUM PRESSURE TOO LOW
CAUSE:	The vacuum level sensor detected a low vacuum level.
CORRECTIVE ACTION:	1. Check all vacuum lines and bottle caps for leaks, cracks, or loose fittings. 2. Call your local Beckman representative*.
MESSAGE:	WASH CONCENTRATE AND/OR PROBE RINSE SOLUTION IS LOW
CAUSE:	The fluid level sensor in the wash concentrate or probe rinse solution bottle detected a low fluid volume.
CORRECTIVE ACTION:	1. Verify that the volume in the wash concentrate or probe rinse solution bottle is actually low. If the volume is low, replace with a new bottle. 2. Perform Hydropneumatic diagnostics, Paragraph 3.8.

MESSAGE:	WASTE BUCKET FULL
CAUSE:	The drain bucket sensor has detected a full bucket.
CORRECTIVE ACTION:	1. Prime Drain Pump. 2. Perform Hydropneumatic diagnostics, Paragraph 3.8.
MESSAGE:	WATER PRESSURE SENSOR FAILURE
CAUSE:	The system has detected a water pressure sensor failure.
CORRECTIVE ACTION:	1. Check the connections of DI water pressure sensor (refer to the figure on the following page). 2. Verify that the DI water source is connected to the instrument and the valve is turned ON. 3. View the STATUS MONITOR to verify DI water pressure. 4. Call your local Beckman representative*.

MESSAGE:	1. WATER PRESSURE TOO HIGH or 2. WATER PRESSURE TOO LOW
CAUSE:	The water pressure sensor detected water pressure that is out of specification.
CORRECTIVE ACTION:	1. Verify that the DI water source is connected to the instrument and the valve is turned ON.



1 - DI Water Source Valve (ON Position)
2 - DI Water Pressure Gauge

2. View the DI Water Gauge and STATUS MONITOR to verify DI water pressure.
3. Check for air leaks in the pneumatic system.
4. Call your local Beckman representative*.

2.1.1.2 CX3 ERRORS (CX7 users only)

MESSAGE:	A DAC INITIALIZATION ERROR INDICATES THAT THE GLUCOSE ELECTRODE MUST BE RECHARGED.
CAUSE:	The initial conductance (IC) is too low for glucose. IC should be greater than -1796.
CORRECTIVE ACTION:	1. Check glucose reagent and wash solution levels and observe fluid through lines. 2. Recharge the glucose electrode (Section 9 of the Operating Instructions).

MESSAGE:	A ROTATIONAL ERROR HAS OCCURRED FOR THE SAMPLE CRANE
CAUSE:	A motion error occurred when the CX3 sample crane attempted to rotate.
CORRECTIVE ACTION:	1. Press **HOME** when in Standby. Observe system for obstruction in path of sample probe movement. 2. Perform diagnostics, Paragraph 3.11.2.
MESSAGE:	AN ADC TIMEOUT ERROR HAS OCCURRED.
CAUSE:	While system was running, a response was delayed, possibly caused by a hardware problem.
CORRECTIVE ACTION:	1. Press **HOME** and attempt to run the system again. If the error persists, reboot the system using option #2 and recalibrate the system. 2. Refer to ADC Diagnostics (Paragraph 3.10) for further troubleshooting assistance.
MESSAGE:	AN ERROR HAS OCCURRED IN LOWERING THE SAMPLE CRANE
CAUSE:	A motion error occurred when the CX3 sample crane attempted to move down.
CORRECTIVE ACTION:	1. Press **HOME** when in Standby. Observe system for obstruction in path of sample probe movement. 2. Perform diagnostics, Paragraph 3.11.2.
MESSAGE:	AN ERROR HAS OCCURRED IN RAISING THE SAMPLE CRANE
CAUSE:	A motion error occurred when the CX3 sample crane attempted to move up.
CORRECTIVE ACTION:	1. Press **HOME** when in Standby. 2. Perform diagnostics, Paragraph 3.11.2.
MESSAGE:	AN ERROR HAS OCCURRED ON PINCH VALVE ‘C’
CAUSE:	A motion error occurred with Pinch Valve ‘C’
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform diagnostics, Paragraph 3.11.4.
MESSAGE:	AN ERROR HAS OCCURRED ON PINCH VALVE ‘E’
CAUSE:	A motion error occurred with Pinch Valve ‘E’
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform diagnostics, Paragraph 3.11.4.
MESSAGE:	AN ERROR IN ADC SEQUENCE TIMING HAS OCCURRED FOR...
CAUSE:	The CPU timing took too long which caused an error in ADC sequence timing.
CORRECTIVE ACTION:	1. Press **HOME** and attempt to run the system again. If error persists, press the reset button and recalibrate system.

MESSAGE:	AN ERROR IN DAC INITIALIZATION HAS OCCURRED FOR...
CAUSE:	This occurs when a chemistry cannot set its electronic digital analog convertors properly. This check assures that the chemistry is operating within the linear range of its electronics.
CORRECTIVE ACTION:	1. Check detector and electrode connections for respective chemistry. 2. Check reagent levels. 3. Check connections on the respective analog board. 4. Power system down and reseat respective analog board. Power system up and recalibrate.
MESSAGE:	A DAC INITIALIZATION ERROR HAS OCCURRED FOR CREA
CAUSE:	This occurs when a chemistry cannot set its electronic digital analog converters properly. This check assures that the chemistry is operating within the linear range of its electronics.
CORRECTIVE ACTION:	1. Check cup and lines for buildup of crystals or precipitate. Clean if necessary (Section 9 of the Operating Instructions). 2. Check lamp voltages and adjust if necessary (Paragraph 4.23)
MESSAGE:	CALIBRATION FAILURE LEVEL _____ CHEM CALIBRATION ERRORS CO_2 SPAN
CAUSE:	Span and range errors due to overlap of ranges due to incorrect calibrator.
CORRECTIVE ACTION:	1. Verify that the correct calibrators are used. 2. Verify that there is sufficient calibrator in each cup.

MESSAGE: CALIBRATION CANCELLED - A RUNTIME DIAGNOSTICS ERROR WAS DETECTED

CAUSE: During calibration the instrument encountered an insufficient reagent strength (BUN3 only) or an excessive reference drift error.

CORRECTIVE ACTION:

1. For **insufficient reagent strength - BUN:**
   - (a) Check BUN reagent and wash solution levels.
   - (b) Check BUN electrode connections.
   - (c) Check for stirrer rotation.
   - (d) Check for correct BUN reagent and wash solution line connections.
2. For an **excessive reference drift error:**
   - (a) Check reagent and damper levels. Prime five times.
   - (b) Check for fluid leakage around fittings, electrodes, dampers and pumps.
   - (c) Prime ratio pump five times and recalibrate.
   - (d) Wait for newly installed electrodes to equilibrate.
   - (e) Check flow cell solenoid valve for proper operation. Perform diagnostics, paragraph 3.11.5.
   - (f) Check for possible problem samples (i.e.; highly turbid samples or samples containing interfering substances, some flame standards fall into this category).

MESSAGE: CALIBRATION CANCELLED - NO CALIBRATOR DETECTED IN CUP

CAUSE: No calibrator was detected in cup.

CORRECTIVE ACTION:

1. Verify that there is sufficient calibrator in cup.

MESSAGE: CX3: SAMPLE NOT DETECTED

CAUSE: No sample was detected by the CX3 level sense mechanism.

CORRECTIVE ACTION:

1. Fill a 2 mL sample cup to the mark with sample in question and repeat.
2. Check CX3 sample crane cable connectors.
3. Perform Sample Probe Maintenance.
4. Perform diagnostics, Paragraph 3.11.
5. Change sample probe, Paragraph 4.21.

MESSAGE:	ERRATIC ADC VALUES COLLECTED FOR... (electrolytes only)
CAUSE:	The range of four ADC readings taken was greater than the allowed limit for that chemistry.
CORRECTIVE ACTION:	1. Verify that the flow cell cover is properly positioned. 2. Check the reagent levels. 3. Check for pinched or blocked tubing. 4. Check for air bubbles in ratio pump cylinders 4 and 5. 5. Perform flow cell cleaning procedure (Section 9 of the Operating Instructions). 6. Remove appropriate chemistry electrode (Na, Na Ref., CO_2 or CO_2 Ref.) and check for air bubbles. 7. Check for salt build-up on electrolyte drain assembly. Clean if necessary (Section 9 of the Operator's Instructions). 8. Check for loose ground connections and solution ground connectors on the electrode bulkhead and analog board. 9. Call your local Beckman representative.*
MESSAGE:	ERRATIC ADC VALUES COLLECTED FOR GLUCOSE
CAUSE:	The system has detected an electronic disturbance during the sample measurement period.
CORRECTIVE ACTION:	1. Check reagent and wash fluid levels at the bottles and cup assembly. 2. Check reagent and wash fluid expiration dates. 3. Rerun sample. 4. Check for pinched or blocked tubing at: (a) C-Cam (b) Wash and reagent lines (c) Peri-pumps 5. Verify the electrode is properly connected. 6. Recalibrate glucose. 7. Recharge glucose electrode (Section 9 of the Operating Instructions). 8. Call your local Beckman representative.*
MESSAGE:	ERROR SYNCHRONIZING CX3 SAMPLE PROBE AND CX4 SAMPLE CAROUSEL
CAUSE:	The CX3 motions are no longer synchronized with the CX4 motions.
CORRECTIVE ACTION:	1. Press **HOME** when system is in standby. 2. Perform diagnostics, Paragraph 3.5.13.

MESSAGE:	EXCESSIVE REFERENCE DRIFT MEASURED FOR... (electrolytes only)
CAUSE:	A drift in electrolyte reference ADC values has exceeded the acceptance limits (from the last calibration performed and/or from sample to sample).
CORRECTIVE ACTION:	1. Check reagent and damper levels. Prime five times. 2. Check for fluid leakage around fittings, electrodes, dampers and pumps. 3. Prime ratio pump five times and recalibrate. 4. Wait for newly installed electrodes to equilibrate. 5. Check flow cell solenoid valve for proper operation. Perform diagnostics, Paragraph 3.11.5. 6. Check for possible problem samples (i.e.; highly turbid samples or samples containing interfering substances, some flame standards fall into this category).
MESSAGE:	GLUCOSE GAIN ERROR
CAUSE:	The system has detected a change in the Initial Conductance (IC) ADC from one sample to the next to be greater than 150 ADC's.
CORRECTIVE ACTION:	1. Check all electrode and cable connections. 2. Check glucose reagent delivery to the reaction cup. 3. Check glucose electrode membrane and gel, recharge electrode if necessary. 4. Check connections on the Analog board. 5. Check glucose reaction cup temperature. 6. Call your local Beckman representative*.
MESSAGE:	INSUFFICIENT REAGENT STRENGTH - BUN3
CAUSE:	This message occurs if the Initial Conductance (IC) is >3200 ADC's.
CORRECTIVE ACTION:	1. Check BUN3 reagent and wash solution levels. 2. Check BUN3 electrode connections. 3. Check drain, fill, and sipping of cup and observe primes. 4. Check for stirrer rotation. 5. Check for correct BUN3 reagent and wash solution line connections.

MESSAGE:	INSUFFICIENT REAGENT STRENGTH - GLU3
CAUSE:	This message occurs if the initial conductance is less than -3000 ADC's.
CORRECTIVE ACTION:	1. Check GLU3 reagent and wash solution levels. 2. Check GLU3 electrode connections. 3. Check drain, fill, and sipping of cup and observe primes. 4. Check for stirrer rotation. 5. Check for correct GLU3 reagent and wash solution line connections. 6. Recharge glucose electrode. 7. Replace GLU3 reagent.
MESSAGE:	MMC CHECKSUM ERROR
CAUSE:	Indicates a serious CX3 communication error or the CX3 is no longer on line with the CX4.
CORRECTIVE ACTION:	1. Press **HOME**. 2. Perform diagnostics, Paragraph 3.10.3.
MESSAGE:	MMC RESPONSE ERROR
CAUSE:	Indicates a serious CX3 communication error or the CX3 is no longer on line with the CX4.
CORRECTIVE ACTION:	1. Press **HOME**. 2. Perform diagnostics, Paragraph 3.10.3.
MESSAGE:	MMC TIMEOUT ERROR
CAUSE:	Indicates a serious CX3 communication error or the CX3 is no longer on line with the CX4.
CORRECTIVE ACTION:	1. Press **HOME**. 2. Perform diagnostics, Paragraph 3.10.3.
MESSAGE:	MOTION ERROR - CX3 PROBE NOT CLEAR
CAUSE:	A motion error occurred when the CX3 probe attempted to move.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Check for obstruction of probe movement. 3. Perform diagnostics, Paragraph 3.11.2
MESSAGE:	MOTION ERROR - CX3 RATIO PUMP
CAUSE:	A motion error occurred when the CX3 ratio pump attempted to move.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform diagnostics, Paragraph 3.11.7.

MESSAGE:	ONE OR MORE CHEMISTRIES HAVE FAILED CALIBRATION.
CAUSE:	Calibrators may be expired, or may have evaporated if left on the system too long before calibration was started.
CORRECTIVE ACTION:	1. Check expiration date of calibrator. 2. Check reagent levels and expiration dates. 3. Prime system, then recalibrate. (While priming verify that stirrer bars are spinning.) 4. If a cup chemistry failed, check drain, fill, and sipping of cup and observe primes. Verify temperature LED's are working (flashing on and off). 5. Verify that all maintenance procedures have been done on a regular basis. (Section 9 of the Operating Instructions).
MESSAGE:	REAGENT VOLUME LOW...
CAUSE:	The system has determined that a particular reagent level is low. This can occur if a reagent is loaded without going through the proper "reagent load" sequence.
CORRECTIVE ACTION:	1. Check reagent and replace (reload) if necessary. 2. Adjust volume level as appropriate. (Section 6, Paragraph 6.2.3 Operating Instructions).
MESSAGE:	SAMPLE WAS DETECTED WHILE THE PROBE WAS IN THE UP POSITION
CAUSE:	Liquid on the probe tip has triggered the level sense detector.
CORRECTIVE ACTION:	1. Perform sample probe maintenance (Section 9, Operating Instructions). If error persists, call your local Beckman representative*.
MESSAGE:	A HOME ERROR HAS OCCURRED FOR THE RATIO PUMP
CAUSE:	A motion error occurred when the CX3 ratio pump attempted to move.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY 2. Perform diagnostics, Paragraph 3.11.7.

2.1.1.3 ISE Module ERRORS (CX5 users only)

MESSAGE:	A ROTATIONAL ERROR HAS OCCURRED FOR THE SAMPLE CRANE
CAUSE:	A motion error occurred when the ISE sample crane attempted to rotate.
CORRECTIVE ACTION:	1. Press **HOME** when in Standby. Observe system for obstruction in path of sample probe movement. 2. Perform diagnostics, Paragraph 3.14.2.

MESSAGE:	AN ADC TIMEOUT ERROR HAS OCCURRED.
CAUSE:	While system was running, a response was delayed, possibly caused by a hardware problem.
CORRECTIVE ACTION:	1. Press **HOME** and attempt to run the system again. If the error persists, reboot the system using option #2 and recalibrate the system. 2. Refer to ADC Diagnostics (Paragraph 3.13) for further troubleshooting assistance.
MESSAGE:	AN ERROR HAS OCCURRED IN LOWERING THE SAMPLE CRANE
CAUSE:	A motion error occurred when the ISE sample crane attempted to move down.
CORRECTIVE ACTION:	1. Press **HOME** when in Standby. Observe system for obstruction in path of sample probe movement. 2. Perform diagnostics, Paragraph 3.14.2.
MESSAGE:	AN ERROR HAS OCCURRED IN RAISING THE SAMPLE CRANE
CAUSE:	A motion error occurred when the ISE sample crane attempted to move up.
CORRECTIVE ACTION:	1. Press **HOME** when in Standby. 2. Perform diagnostics, Paragraph 3.14.2.
MESSAGE:	AN ERROR HAS OCCURRED ON PINCH VALVE ‘E’
CAUSE:	A motion error occurred with Pinch Valve ‘E’
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform diagnostics, Paragraph 3.14.3.
MESSAGE:	AN ERROR IN ADC SEQUENCE TIMING HAS OCCURRED FOR...
CAUSE:	The CPU timing took too long which caused an error in ADC sequence timing.
CORRECTIVE ACTION:	1. Press **HOME** and attempt to run the system again. If error persists, reboot the system using option #2 and recalibrate system.
MESSAGE:	AN ERROR IN DAC INITIALIZATION HAS OCCURRED FOR...
CAUSE:	This occurs when a chemistry cannot set its electronic digital analog convertors properly. This check assures that the chemistry is operating within the linear range of its electronics.
CORRECTIVE ACTION:	1. Check detector and electrode connections for respective chemistry. 2. Check reagent levels. 3. Check connections on the respective analog board. 4. Power system down and reseat respective analog board. Power system up and recalibrate.

MESSAGE: CALIBRATION CANCELLED - A RUNTIME DIAGNOSTICS ERROR WAS DETECTED

CAUSE: During calibration the instrument encountered an excessive reference drift error.

CORRECTIVE ACTION:

1. For an **excessive reference drift error**:
   a. Check reagent and debubbler levels. Prime five times.
   b. Check for fluid leakage around fittings, electrodes, debubblers and pumps.
   c. Prime ratio pump five times and recalibrate.
   d. Wait for newly installed electrodes to equilibrate.
   e. Check flow cell solenoid valve for proper operation. Perform diagnostics, Paragraph 3.14.4
   f. Check for possible problem samples (i.e.; highly turbid samples or samples containing interfering substances, some flame standards fall into this category).

MESSAGE: CALIBRATION FAILURE LEVEL _____

CHEM	CALIBRATION ERRORS
CO_2	SPAN

CAUSE: Span and range errors due to overlap of ranges due to incorrect calibrator.

CORRECTIVE ACTION:

1. Verify that the correct calibrators are used.
2. Verify that there is sufficient calibrator in each cup.

MESSAGE: SAMPLE NOT DETECTED

CAUSE: No sample was detected by the ISE level sense mechanism.

CORRECTIVE ACTION:

1. Fill a 2 mL sample cup to the mark with sample in question and repeat.
2. Check ISE sample crane cable connectors.
3. Perform Sample Probe Maintenance.
4. Perform diagnostics, Paragraph 3.14.
5. Change sample probe, Paragraph 4.34.

MESSAGE:	ERRATIC ADC VALUES COLLECTED FOR ... (electrolytes only)
CAUSE:	The range of four ADC readings taken was greater than the allowed limit for that chemistry.
CORRECTIVE ACTION:	1. Verify that the flow cell cover is properly positioned. 2. Check the reagent levels. 3. Check for pinched or blocked tubing. 4. Check for air bubbles in ratio pump cylinders 4 and 5. 5. Perform flow cell cleaning procedure (Section 9 of the Operating Instructions). 6. Check for salt build-up on electrolyte drain assembly. Clean if necessary (Section 9 of the Operating Instructions). 7. Check for loose ground connections and solution ground connectors on the electrode bulkhead and analog board. 8. Call your local Beckman representative*.
MESSAGE:	ERROR SYNCHRONIZING ISE SAMPLE PROBE AND CX4 SAMPLE CAROUSEL
CAUSE:	The ISE motions are no longer synchronized with the CX4 motions.
CORRECTIVE ACTION:	1. Press **HOME** when system is in standby. 2. Perform diagnostics, Paragraph 3.5.13.
MESSAGE:	EXCESSIVE REFERENCE DRIFT MEASURED FOR ... (electrolytes only)
CAUSE:	A drift in electrolyte reference ADC values has exceeded the acceptance limits (from the last calibration performed and/or from sample to sample).
CORRECTIVE ACTION:	1. Check reagent and debubbler levels. Prime five times. 2. Check for fluid leakage around fittings, electrodes, debubblers and pumps. 3. Prime ratio pump five times and recalibrate. 4. Wait for newly installed electrodes to equilibrate. 5. Check flow cell solenoid valve for proper operation. Perform diagnostics, Paragraph 3.14.4. 6. Check for possible problem samples (i.e.; highly turbid samples or samples containing interfering substances, some flame standards fall into this category).
MESSAGE:	MMC CHECKSUM ERROR
CAUSE:	Indicates a serious ISE communication error or the ISE is no longer on line with the CX4.
CORRECTIVE ACTION:	1. Press **HOME**. 2. Perform diagnostics, Paragraph 3.13.3.

MESSAGE:	MMC RESPONSE ERROR
CAUSE:	Indicates a serious ISE communication error or the ISE is no longer on line with the CX4.
CORRECTIVE ACTION:	1. Press **HOME**. 2. Perform diagnostics, Paragraph 3.13.3.
MESSAGE:	MMC TIMEOUT ERROR
CAUSE:	Indicates a serious ISE communication error or the ISE is no longer on line with the CX4.
CORRECTIVE ACTION:	1. Press **HOME**. 2. Perform diagnostics, Paragraph 3.13.3.
MESSAGE:	MOTION ERROR - ISE PROBE NOT CLEAR
CAUSE:	A motion error occurred when the ISE probe attempted to move.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Check for obstruction of probe movement. 3. Perform diagnostics, Paragraph 3.14.2
MESSAGE:	ONE OR MORE CHEMISTRIES HAVE FAILED CALIBRATION.
CAUSE:	Calibrators may be expired, or may have evaporated if left on the system too long before calibration was started.
CORRECTIVE ACTION:	1. Check expiration date of calibrator. 2. Check reagent levels and expiration dates. 3. Prime system, then recalibrate. 4. Verify that all maintenance procedures have been done on a regular basis. (Section 9 of the Operating Instructions).
MESSAGE:	REAGENT VOLUME LOW ...
CAUSE:	The system has determined that a particular reagent level is low. This can occur if a reagent is loaded without going through the proper “reagent load” sequence.
CORRECTIVE ACTION:	1. Check reagent and replace (reload) if necessary. 2. Adjust volume level as appropriate. (Section 6, Paragraph 6.2.3 Operating Instructions).
MESSAGE:	SAMPLE WAS DETECTED WHILE THE PROBE WAS IN THE UP POSITION
CAUSE:	Liquid on the probe tip has triggered the level sense detector.
CORRECTIVE ACTION:	1. Perform sample probe maintenance (Section 9, Operating Instructions). If error persists, call your local Beckman representative*.

MESSAGE:	A HOME ERROR HAS OCCURRED FOR THE RATIO PUMP
CAUSE:	A motion error occurred when the ISE ratio pump attempted to move.
CORRECTIVE ACTION:	1. Press **HOME** when in STANDBY. 2. Perform diagnostics, Paragraph 3.14.6.

2.1.2 Error Messages Generated when START is pressed (in alphabetical order)

MESSAGE:	CANNOT RUN : AIR PRESSURE OUT OF RANGE
CAUSE:	When **START** was pressed, the system detected the air pressure to be out of range.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Verify air pressure level. 3. Check for loose tubing or fittings. 4. Adjust air pressure level if necessary. 5. Call your local Beckman representative*.
MESSAGE:	CANNOT RUN : DI WATER LEVEL LOW
CAUSE:	When **START** was pressed, the system detected low DI water pressure.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Check hydropneumatic tubing connections. 3. Verify the water inlet valve is turned on. 4. Call your local Beckman representative*.
MESSAGE:	CANNOT RUN : MOTION SYSTEM REQUIRES HOMING
CAUSE:	When **START** was pressed, Synchron CX assemblies were not at their HOME position.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Press **HOME**.
MESSAGE:	CANNOT RUN : UNABLE TO FILL THE DILUTED WASH BOTTLE
CAUSE:	When **START** was pressed, an error occurred preventing the system from filling one of the diluted wash bottles.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Fill wash bottles through the PRIME function. 3. Perform Diagnostics Paragraph 3.8.2 (hydro system mix wash test).

MESSAGE:	CANNOT RUN : VACCUUM PRESSURE OUT OF RANGE
CAUSE:	When **START** was pressed, the system detected the vacuum pressure to be out of range.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Verify the vacuum pressure and adjust if necessary by priming the hydropneumatics. 3. Call your local Beckman representative*.
MESSAGE:	CANNOT RUN : WATER PRESSURE OUT OF RANGE
CAUSE:	When **START** was pressed, the system detected the water pressure to be out of range.
CORRECTIVE ACTION:	1. Press **PREV SCREEN**. 2. Prime ALL HYDROPNEUMATICS. 3. Call your local Beckman representative*.
MESSAGE:	CANNOT START : CRITICAL DATABASE ERROR
CAUSE:	A fatal error has occurred corrupting one of several databases.
CORRECTIVE ACTION:	1. Reboot system through System Idle using option 1. 2. Call your local Beckman representative*.
MESSAGE:	CANNOT START : CX4 ANALOG SYSTEM NOT READY
CAUSE:	**START** was pressed after a critical failure of the CX4 Analog Control System.
CORRECTIVE ACTION:	1. Reboot system through System Idle.
MESSAGE:	CANNOT START : DILUTED WASH BOTTLE NEEDS FILLING
CAUSE:	When **START** was pressed, the system detected low fluid volumes in both wash reservoirs. At least one of the wash bottles must register FULL to **START** the system.
CORRECTIVE ACTION:	1. Request a prime of the wash bottles from the PRIME Screen. 2. If the Prime function did not fill the bottles, perform diagnostics, Paragraph 3.8.2.
MESSAGE:	CANNOT START : FATAL ANALOG ERROR
CAUSE:	A fatal error condition was detected within the Analog Control System.
CORRECTIVE ACTION:	1. View and print Event Log #4. 2. Call your local Beckman representative*.

MESSAGE:	CANNOT START : HEATER CALIBRATION CODE DOES NOT MATCH DATA ON DISK
CAUSE:	The calibration constant associated with a particular heater board does not match the calibration constant coded in memory.
CORRECTIVE ACTION:	1. Power down the instrument through System Idle, and remove the heater board in question. (Refer to Paragraph 4.4.) 2. Obtain the FACTORY CALIBRATION DATA from the board. 3. Replace the heater board into the card cage. 4. Boot diagnostics software and perform Paragraph 3.4.2.2.
MESSAGE:	CANNOT START : INITIALIZATION NOT COMPLETE
CAUSE:	**START** was pressed before the system had completed the initialization sequence.
CORRECTIVE ACTION:	1. Wait until the initialization sequence is complete and the SYSTEM STATUS states the instrument is in STANDBY.
MESSAGE:	CANNOT START : MUST BE IN STANDBY
CAUSE:	**START** was pressed when the system was performing some other function. **START** is only valid when the system is in the STANDBY mode.
CORRECTIVE ACTION:	1. Wait until the system finishes the current task and the SYSTEM STATUS states the instrument is in STANDBY. 2. Press **PAUSE**, if instrument is not in standby.
MESSAGE:	CANNOT START : TEMPERATURE/VOLTAGE OUT OF RANGE. CHECK STATUS MONITOR
CAUSE:	One of the temperature control components detected an error.
CORRECTIVE ACTION:	1. Check the Status Monitor to determine the component out of temperature control. 2. Verify all system fans are operating. 3. Perform diagnostics, Paragraph 3.4.
MESSAGE:	CANNOT START : WASH CONCENTRATE OR PROBE RINSE SOLUTION IS LOW
CAUSE:	The fluid level sensor in the wash concentrate or probe rinse solution bottle detected a low volume.
CORRECTIVE ACTION:	1. Verify that the level of wash concentrate or probe rinse solution is actually low. If the fluid level is low, place a new bottle of wash concentrate or probe rinse solution on the system. 2. Verify that the float sensors can move freely. 3. If the fluid level is not low, perform diagnostics, Paragraph 3.8.2.

MESSAGE:	INCOMPATIBLE TEMPERATURE BOARDS
CAUSE:	The calibration constants for either the reaction carousel, cuvette wash water, or cuvette rinse water heater boards do not match those coded in the instrument memory.
CORRECTIVE ACTION:	1. Power down the instrument through System Idle, remove the heater board in question and obtain the calibration constant. (Refer to Paragraph 4.4 for board removal and replacement instructions. Perform Paragraph 3.4.2, 3.4.3, or 3.4.4 to input correct calibration constant.)

2.2 CHEMISTRY FLAGS

Chemistry flags are used to qualify the reagent, calibration, and final result. Any calibrator or sample outside of any one or more limits will be flagged. A flagged sample value will not be reported. Table 2-1 lists the flag codes which may appear on the calibration or result report and Table 2-2 describes each flag.

Table 2-1. Flag Abbreviations for Reports

ABBREVIATION*	NAME
BACK TO BACK	Back-to-Back
BL ABS HI (BH)	Blank Absorbance High
BL ABS LO (BL)	Blank Absorbance Low
BL MEAN DEV (BN)	Blank Mean Deviation
BL MAX DEV (BO)	Blank Max Deviation
BL RATE HI (SH)	Blank Rate High
BL RATE LO (SL)	Blank Rate Low
DAC	Digital to Analog Conversion
OCR HI	Out of Calibrator Range High
OCR LO	Out of Calibrator Range Low
REF DRIFT (DR)	Reference Drift
ERRATIC ADC (EA)	Erratic ADC
INT ABS HI (AH)	Initial Absorbance High
INT RATE HI (IR)	Initial Rate High
INC DATA	Inconsistent Data
MATH ERR 5	Calibrator Order Error for Multipoint Chemistry
MATH ERR #	Math Error/Nonoverrideable
MATH ERR #	Math Error/Overrideable
NOISE (NT)	Noise Threshold
OIR ERR	Out of Instrument Electronic Range
OIR HIGH (HI)	Out of Instrument Range High
OIR LOW (LO)	Out of Instrument Range Low
OIR O HIGH (OH)	ORDAC High
OIR O LOW (OL)	ORDAC Low
ORR HIGH (UH)	Out of Reportable Range High
ORR LOW (UL)	Out of Reportable Range Low
ORR O HIGH (UO)	Out of ORDAC Reportable Range High
OUTLIER (OT)	Outlier Threshold
RECOVERY	Recovery
RX ABS HI (HR)	Reaction Absorbance High
RX ABS LO (LR)	Reaction Absorbance Low
RX MEAN DEV (RN)	Reaction Mean Deviation
RX MAX DEV (RO)	Reaction Max Deviation
RX RATE HI (RH)	Reaction Rate High
RX RATE LO (RL)	Reaction Rate Low
SENSITIVITY	Sensitivity
SEV RECOVERY	Severe Recovery

Table 2-1. Flag Abbreviations for Reports (Continued)

ABBREVIATION*	NAME
SEV SENSITIVITY	Severe Sensitivity
SPAN	Span
SUB DEPL (SD)	Substrate Depletion
TEMP ERR (TM)	Temperature Error
ADC ERROR	ADC ERROR

* The two letter codes in parentheses are the error codes which are transmitted to the host.

Table 2-2. Flag Summary

Blank Absorbance (high/low)	Mean absorbance measured during the reagent blank spin cycles (read window). The units are in Absorbance and will characterize reagent quality.
Blank Maximum Deviation	A single blank absorbance data point obtained during the reagent blank read window deviates more than allowed from the line of regression. The units are in delta absorbance and will check for a constant rate during the blank spin cycles.
Blank Mean Deviation	The average difference between the absorbance readings and the line of regression is greater than allowed. This will check for a constant rate during the blank spin cycles.
Erratic ADCs	The difference between the high and low value of the four reference electrode readings (taken milliseconds apart) has exceeded the limits allowed. Units are in ADC's and are a measurement of noise in the ISE system.
Calibrator Order Error	Occurs in Sector mode when not all calibrator levels are in ascending order (low to high) and/or not all levels reside in the same sector.
Excessive Reference Drift	A CX3/ISE reference electrode measurement for a sample drifted above the reference electrode measurement from the calibration and/or from sample to sample and exceeded the limit. The units are in ADC's and are a measurement of CX3/ISE reference electrode drift.
Initial Absorbance High	The reaction absorbance data taken from the first spin cycle after sample inject has exceeded specifications. This is a measurement of sample integrity.
Initial Rate High	The reaction rate data obtained between 2 and 17 seconds after sample inject exceeds specifications.
Noise	During a particular spin cycle, the average difference between an absorbance reading and the line of regression exceeded specifications.
Outlier	During a particular spin cycle, the deviation of a single absorbance reading with respect to the line of regression exceeded specifications.
Out of Instrument Range (high/low)	The recovered value exceeds the value that the instrument will report.
Out of ORDAC Range (high/low)	A reaction exceeded the range of ORDAC (Over Range Detection And Correction) values that the instrument will report.
Out of Reportable Range (high/low)	The recovered value exceeds the reportable range limits.
Out of ORDAC Reportable Range (high)	A reaction exceeded the high ORDAC reportable range.

Table 2-2. Flag Summary (Continued)

Reaction Absorbance (high/low)	The mean absorbance measured during the reaction spin cycles.
Reaction Maximum Deviation	A single reaction absorbance data point obtained during the reaction read window deviates more than allowed from the line of regression. The units are in delta absorbance and will check for a constant rate during the reaction read window.
Reaction Mean Deviation	The average difference between the reaction absorbance readings and the line of regression is greater than allowed. This will check for a constant rate during the reaction spin cycles.
Reaction Rate (high/low)	The rate calculated during the reaction read window. Units are in delta Absorbance/minute.
Substrate Depletion	Difference (delta) between the initial absorbance taken after sample inject and the final absorbance data point within the reaction read window exceeds specifications.
Temperature	The operating temperature of the system is beyond 0.1°C from the set point value. All CX4 Chemistry results will be reported with a flag.
ADC ERROR	More than 1 second elapsed between start and end of ADC conversion process.

2.2.1 Calibration Error Flags

In addition to the error checking done on the calibration results indicated above, additional flagging is applied specifically to the calibration process as described below.

2.2.1.1 Linear Chemistries

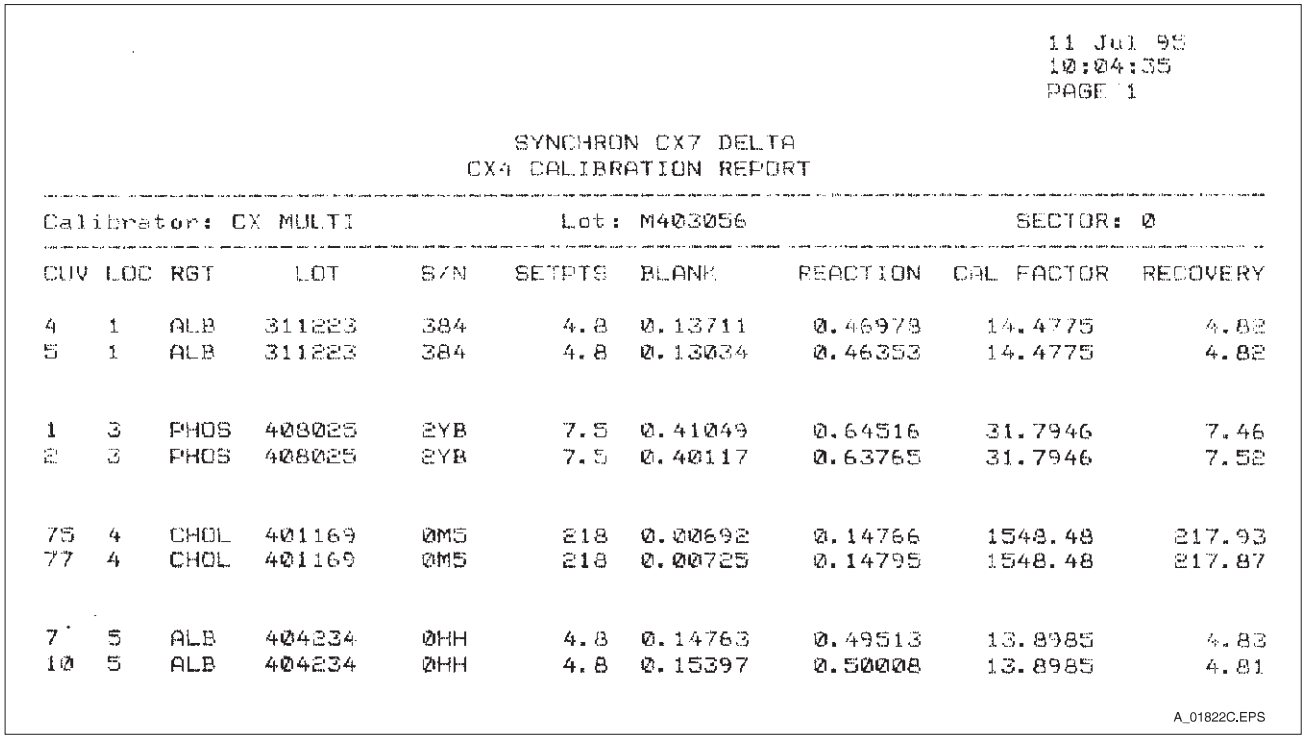
For all non-enzyme, linear photometric chemistries, the CX4, CX5 and CX7 will set calibration based on four calibrator replicates. The instrument will determine and discard the highest and lowest of the four replicates. The remaining two values are called the usable calibrator replicates. Only the two usable replicates will be reported. The average value of the usable calibrator replicates is used to determine the calibration factor. (Refer to Section 4 of the Operating Instructions manual for calibration theory.)

Calibration will fail only if one or more of the usable replicates is flagged. Calibration flags that are specific only to the linear photometric chemistries which will cause the reagent to fail its calibration are as follows:

Back-to-Back Difference between usable calibrator replicates. Units are dependent on the reagent. Measure of system precision during calibration.

Calibrator range (high/low) Absorbance or rate range that the usable calibrator replicates must fall between for a valid calibration. Measure of reagent performance.

The calibration report can be a valuable aid in identifying any problem that can occur. Figure 2-1 is a typical example of a calibration report for the linear chemistries.



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SYNCHRON CX7 DELTA
CX4 CALIBRATION REPORT

Calibrator: CX MULTI Lot: M403056 SECTOR: 0

CUV	LOC	RGT	LOT	S/N	SETPTS	BLANK	REACTION	CAL FACTOR	RECOVERY
4	1	ALB	311223	384	4.8	0.13711	0.46978	14.4775	4.82
5	1	ALB	311223	384	4.8	0.13034	0.46353	14.4775	4.82
1	3	PHOS	408025	2YB	7.5	0.41049	0.64516	31.7946	7.46
2	3	PHOS	408025	2YB	7.5	0.40117	0.63765	31.7946	7.52
75	4	CHOL	401169	0M5	218	0.00692	0.14766	1548.48	217.93
77	4	CHOL	401169	0M5	218	0.00725	0.14795	1548.48	217.87
7	5	ALB	404234	0HH	4.8	0.14763	0.49513	13.8985	4.83
10	5	ALB	404234	0HH	4.8	0.15397	0.50008	13.8985	4.81

A_01822C.EPS

Figure 2-1. Calibration Report

Calibration Report Definitions

CUV The cuvette number on the reaction carousel in which the reaction took place.

LOC Position that the reagent cartridge occupies on the reagent carousel.

BLANK This is the reagent blank absorbance if it is an ENDPOINT chemistry or the reagent blank rate (absorbance per unit time) if it is a RATE chemistry.

REACTION This is the reaction absorbance if it is an ENDPOINT chemistry or the reaction rate (absorbance per unit time) if it is a RATE chemistry. For ENDPOINT 2 or RATE 2 reactions, the blank absorbance must be subtracted from this value to obtain the net delta absorbance.

CAL FACTOR Value by which the final absorbance is multiplied to obtain the concentration.

RECOVERY The concentration obtained when the final absorbance of each of the replicates used is multiplied by the determined Cal Factor. An indication of how well the calibration set.

CONDITION In the event that an error occurred, an asterisk (*) will appear by the value which is out of specification. The corresponding error flag will be printed in this field. Only those errors that FAIL the calibration will be printed.

MAGNITUDE This is an indication of the severity of the failure. Depending on the error, the magnitude may reflect the actual value of the error or it may be the absolute difference between the limit and the actual value. Likewise, the magnitude may not be applicable to the error which has occurred. If this is the case, no value will appear under this field.

Table 2-3. Magnitude of Error (Linear Chemistries)

ERROR FLAG	MAGNITUDE
BLANK RATE	absolute delta
BLANK ABS	absolute delta
RXN RATE	absolute delta
RXN ABS	absolute delta
INT ABS HI	actual value
INT RATE HI	actual
BACK TO BACK	absolute delta
OCR	absolute delta
All others	no magnitude

2.2.1.2 Nonlinear Multi-point Chemistries

The multi-point chemistries set calibration based on a single determination of each calibrator level (five or six levels). The standard curve is determined by use of one of several nonlinear math models. These chemistries have a set of calibration flags specific only for multi-point analysis. The first criterion determines if the data is reasonable to attempt the curve fitting. The second check determines if the multi-point span is within acceptable limits. The next set of errors are inherent to nonlinear curve fitting and may or may not cause calibration failure. Under certain conditions the curve fitting will produce parameters and curves that may contain mathematical errors. Typically these errors will occur outside of the reagent dynamic range and have no effect on sample recovery. There are two possible results of a math error depending on the severity: 1) nonoverrideable calibration failure, or 2) overrideable calibration failure. Math errors are reported as "MATH ERROR #" with the number being associated with a specific error which has occurred.

NOTE

Failed multi-point calibration errors will be noted with an (*) at the bottom of the calibration report.

Multi-point, nonlinear calibration is monitored using the following error flags:

Inconsistent Data Multi-point calibrator rates or absorbances must be increasing or decreasing in the correct order or a math error will occur. The program looks at multi-point span to determine that all calibrator results are increasing or decreasing. Indication that calibrators were run out of order or a flier occurred.

Iteration Error Multi-point calibration curve cannot be fit into the math model. The curve parameters are not reported and the calibration may not be overridden.

Multi-point Span Difference between consecutive calibrator rates or absorbances. There can be up to 6 multi-point spans for level 0-1, 1-2, 2-3, 3-4, 4-5, 5-0. Measure of sensitivity is over the entire standard curve.

Recovery Determines if recovery errors of each calibration level are too large for a calibration to be useful. The difference between the recovered concentration and the actual concentration exceeds specification. Is overrideable.

Severe Recovery Nonoverrideable extreme recovery error. See RECOVERY ERROR.

Sensitivity A check of the calibration slope for each calibrator level and several intermediate levels to check if the response is too high or low. Is overrideable.

Severe Sensitivity A nonoverrideable extreme sensitivity error. See SENSITIVITY ERROR.

Math error 1 Multi-point calibration error. Algorithm produces curve parameters that are very large or small and/or rounding errors will give an invalid standard curve. Curve parameters are not reported and calibration may not be overridden.

Math error 2 Computer is not able to calculate the parameters needed to determine the other math errors. Curve parameters are not reported and calibration may not be overridden.

Math error 3 The range of data points is on a very small percent of the overall calculated curve. Curve is not sensitive enough to get valid sample results. Curve parameters are not reported and calibration may not be overridden.

Math error 5 Calculated curve has multiple inflection points within the dynamic range indicating more than one result is possible for the same data point. Curve parameters are not reported and calibration may not be overridden.

Math error 6 Data does not properly define the curve. Only one point is near the inflection point of the curve. Curve parameters are not reported and calibration may not be overridden.

Math error 8 Data does not properly define the curve. Only one point is near the inflection point of the curve. Results need to be evaluated by the user. Curve parameters are reported and calibration may be overridden. A less severe MATH ERROR 6.

The calibration report can be a valuable aid in identifying any problem that can occur. Figure 2-2 is a typical example of a calibration report for the multi-point chemistries.

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SYNCHRON CX7 DELTA
MULTI POINT CALIBRATION REPORT

Calibrator: CX IMMUNO Lot: M411009 SECTOR: 1

TEST: IGM REAGENT LOT: 502230 LOC: 10 CAL MODEL: 9

CUV	CAL LEV	SETPOINT	BLANK	REACTION	CALCULATED DEVIATION	RECOVERY
75	1	25	0.01034	0.02224	-0.00005	24.83
77	2	62	0.00976	0.03504	0.00016	62.43
79	3	125	0.00848	0.05654	-0.00029	124.16
1	4	186	0.00939	0.07681	0.00028	187.02
3	5	249	0.00917	0.09128	-0.00010	248.52

Standard Deviation of the Curve: 0.00022

Curve Parameters: R0: 6.34696 Kc: 144.46840 a: -7.84465
b: 1.44000 c: 1.00000

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Figure 2-2. Calibration Report

Calibration Report Definitions

LOCATION Position that the reagent cartridge occupies on the reagent carousel.

CUV The cuvette number on the reaction carousel in which the reaction took place.

BLANK This is the reagent blank absorbance if it is an ENDPOINT chemistry or the reagent blank rate (absorbance per unit time) if it is a RATE chemistry.

REACTION This is the reaction absorbance if it is an ENDPOINT chemistry or the reaction rate (absorbance per unit time) if it is a RATE chemistry. For ENDPOINT 2 or RATE 2 reactions, the blank absorbance must be subtracted from this value to obtain the net delta absorbance.

CALC DEVIATION Difference between the obtained absorbance value and the curve in terms of absorbance.

RECOVERY The concentration obtained when the final absorbances of the calibrators are applied to the calculated curve.

STANDARD DEVIATION OF THE CURVE The standard deviation of all the calculated deviation values. Indication of curve fit.

CURVE PARAMETERS (Ro, Kc, a, b, c) Positioning and scaling factors for curve determination.

CONDITION In the event that an error occurred, an asterisk (*) will appear by the value which is out of specification. The corresponding error flag will be printed in this field. Only those errors that FAIL the calibration will be printed.

MAGNITUDE This is an indication of the severity of the failure. Depending on the error, the magnitude may reflect the actual value of the error or it may be the absolute difference between the limit and the actual value. Likewise, the magnitude may not be applicable to the error which has occurred. If this is the case, no value will appear under this field.

Table 2-4. Magnitude of Error (Nonlinear Multi-Point Chemistries)

ERROR FLAG	MAGNITUDE
BLANK RATE	absolute delta
BLANK ABS	absolute delta
RXN RATE	absolute delta
RXN ABS	absolute delta
INT ABS HI	actual value
SPAN	absolute delta
All others	no magnitude

2.2.1.3 CX3/ISE Chemistries (CX7 and CX5 users only)

The instrument will calibrate based on the average value of two replicates for each of the assigned calibrators for each chemistry. The analog signals generated by the calibrator measurements are converted to digital form. The resulting ADC values are compared to the pre-programmed error limits to determine the integrity of the calibration. The error flags specific to CX3/ISE calibration are as follows:

Back-to-Back Measure of system precision during calibration. The difference between any two consecutive replicate values. If the back-to-back limit is exceeded on the first two replicate values, a third determination is made. If the back-to-back between replicate values for 2 and 3 exceeds the limit, a fourth determination is made. If the back-to-back between replicate values for 3 and 4 exceed the limit, calibration fails. Only the two consecutive replicates that meet back-to-back are used; all other replicates are discarded. Limits are as follows:

Na	15 (Cal 1,2) 75 (Cal 3)	BUN3	20 (Cal 1) 32 (Cal 2)	CALC (ISE)	10
K	10	CA3	10	TP3	(View calibrator acceptance limits)*
Cl	12	CRE3	16		
CO_2	<5%	GLU3	24		

Calibrator Range (high/low) Measure of reagent and electrode performance. Determines if the calibrator set points fall within the acceptable range of ADC values.

DAC Verifies proper operation of electrodes. The Digital-to-Analog Conversion (DAC) check mimics expected ranges of electrode output. Failure to detect an output within a predetermined range for each channel will trigger a DAC INITIALIZATION ERROR HAS OCCURRED FOR ... flag. Limits are as follows:

Na	-1755 ±60
K	969 ±60
Cl	307 ±60
CO_2	-3500 ±220
CALC (ISE)	-542 ±60

Erratic ADCs The difference between the high and low value of the four electrode readings (taken milliseconds apart) must be within the delta limit. Measure of noise for CX3/ISE system. Limits are as follows

Delta Limits

	Sample	Reference
Na	15	30
K	15	15
Cl	15	30
CALC (ISE)	15	15

Span Difference between the average ADC value of calibrator 1 and the average ADC value of calibrator 2, or the difference between the average ADC value of calibrator 2 and the average ADC value of calibrator 3. Measure of sensitivity.

Math Error 16 % Occurs when calibrations include division by 0.

The calibration report can be a valuable aid in identifying any problem that can occur. Figures 2-3 and 2-4 are typical examples of calibration reports for the CX3/ISE chemistries.

* To view the calibrator acceptance limits (Paragraph 6.3.6 of the Operating Instructions Manual) press **F3 CAL**, **F6 CAL OPTIONS**, and **2**, View calibrator acceptance limits.

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SYNCHRON CX7 DELTA
CX3 CALIBRATION REPORT

Calibrator: CAL STANDARD 1

	BUN3	GLU3	CRE3
1			
RATE	-129	1407	-69
DELTA ABS			
INIT READ	2750	-1926	3609
FINAL READ	-125	-1594	
GAIN		0	
2			
RATE	-128	1401	-70
DELTA ABS			
INIT READ	2631	-1913	3605
FINAL READ	-236	-1584	
GAIN		0	
SET POINT	10	200	1.0
SET POINT UNITS	mg/dL	mg/dL	mg/dL

Calibrator: CAL STANDARD 2

	BUN3	GLU3	CRE3
1			
RATE	-1196	423	-540
DELTA ABS			
INIT READ	2616	-1933	3600
FINAL READ	-1389	-1822	
GAIN		0	
2			
RATE	-1168	405	-547
DELTA ABS			
INIT READ	2579	-1932	3582
FINAL READ	-1349	-1829	
GAIN		0	
3			
RATE	-1153		
DELTA ABS			
INIT READ	2570		
FINAL READ	-1271		
GAIN			
SET POINT	80	50	8.0
SET POINT UNITS	mg/dL	mg/dL	mg/dL
SPAN	1032	990	474

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Figure 2-3. CX3 Calibration Report (CX7 users only)

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SYNCHRON CX7 DELTA
CX3 CALIBRATION REPORT

Calibrator: CAL STANDARD 1

	NA	K	CL	CO2	CALC
1					
SMPL REFERENCE	414	0	-710	-319	23
SAMPLE	-1295	921	-420	-3560/-3391	-543
SMPL DEVIATION	1	0	1		0
REFERENCE	-1709	921	290	-3542/-3054	-566
REF DEVIATION	0	0	0		1
2					
SMPL REFERENCE	408	-2	-709	-304	24
SAMPLE	-1297	917	-417	-3586/-3398	-540
SMPL DEVIATION	0	0	1		0
REFERENCE	-1705	919	292	-3541/-3049	-564
REF DEVIATION	1	1	0		0
SET POINT	100	4.0	20	0	5.0
SET POINT UNITS	mmol/L	mmol/L	mmol/L	mmol/L	mg/dL

Calibrator: CAL STANDARD 2

	NA	K	CL	CALC
1				
SMPL REFERENCE	-392	-627	231	-611
SAMPLE	-2107	292	619	-1182
SMPL DEVIATION	0	0	1	0
REFERENCE	-1715	919	388	-571
REF DEVIATION	1	1	1	0
2				
SMPL REFERENCE	-393	-629	242	-613
SAMPLE	-2104	292	635	-1178
SMPL DEVIATION	1	0	1	0
REFERENCE	-1711	921	393	-565
REF DEVIATION	0	0	1	1
SET POINT	180	10.0	180	14.0
SET POINT UNITS	mmol/L	mmol/L	mmol/L	mg/dL
SPAN	803	627	945	635

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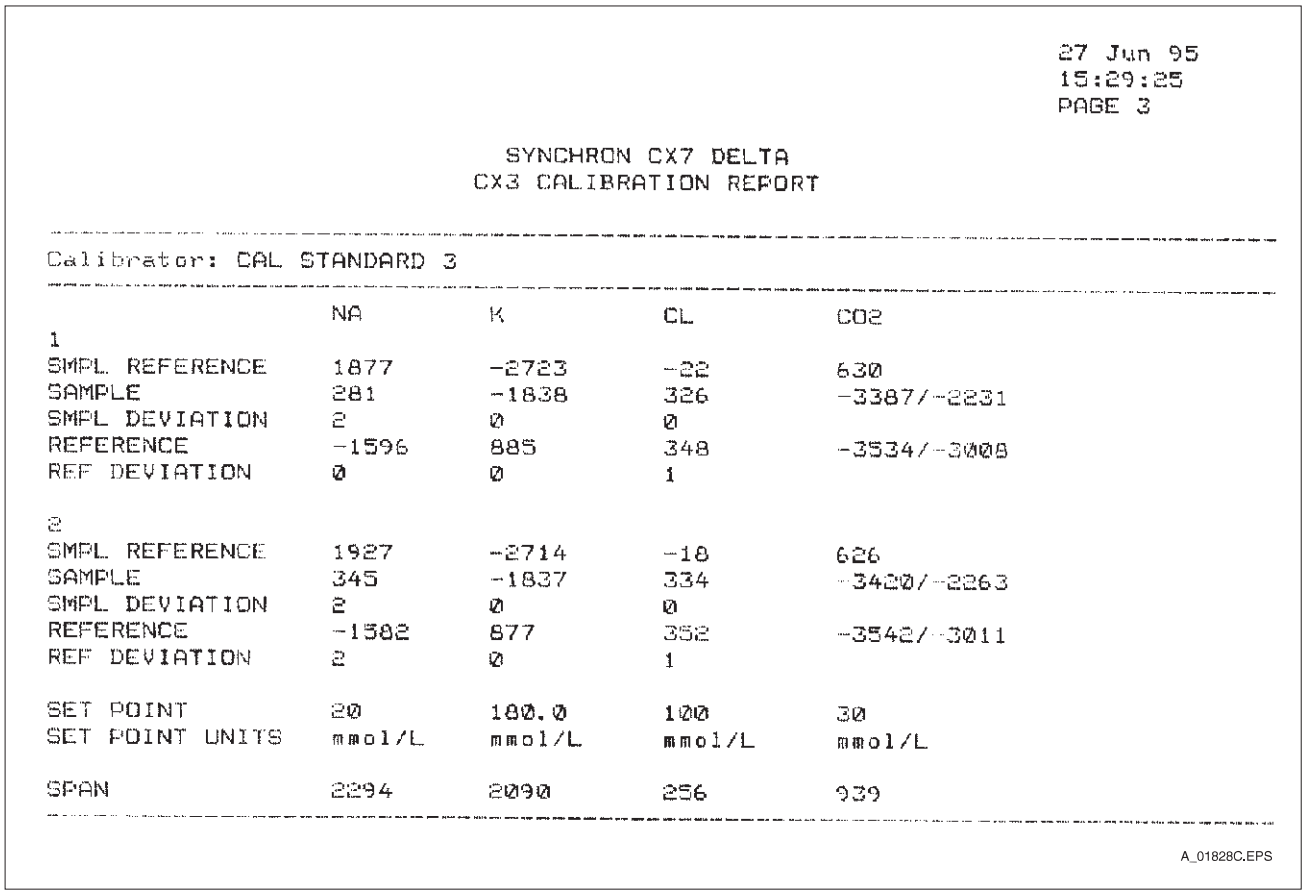
B

Figure 2-3. CX3 Calibration Report (CX7 users only) - Continued



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SYNCHRON CX7 DELTA
CX3 CALIBRATION REPORT

Calibrator: CAL STANDARD 3

	NA	K	CL	CO2
1				
SMPL REFERENCE	1877	-2723	-22	630
SAMPLE	281	-1838	326	-3387/-2231
SMPL DEVIATION	2	0	0	
REFERENCE	-1596	885	348	-3534/-3008
REF DEVIATION	0	0	1	
2				
SMPL REFERENCE	1927	-2714	-18	626
SAMPLE	345	-1837	334	-3420/-2263
SMPL DEVIATION	2	0	0	
REFERENCE	-1582	877	352	-3542/-3011
REF DEVIATION	2	0	1	
SET POINT	20	180.0	100	30
SET POINT UNITS	mmol/L	mmol/L	mmol/L	mmol/L
SPAN	2294	2090	256	939

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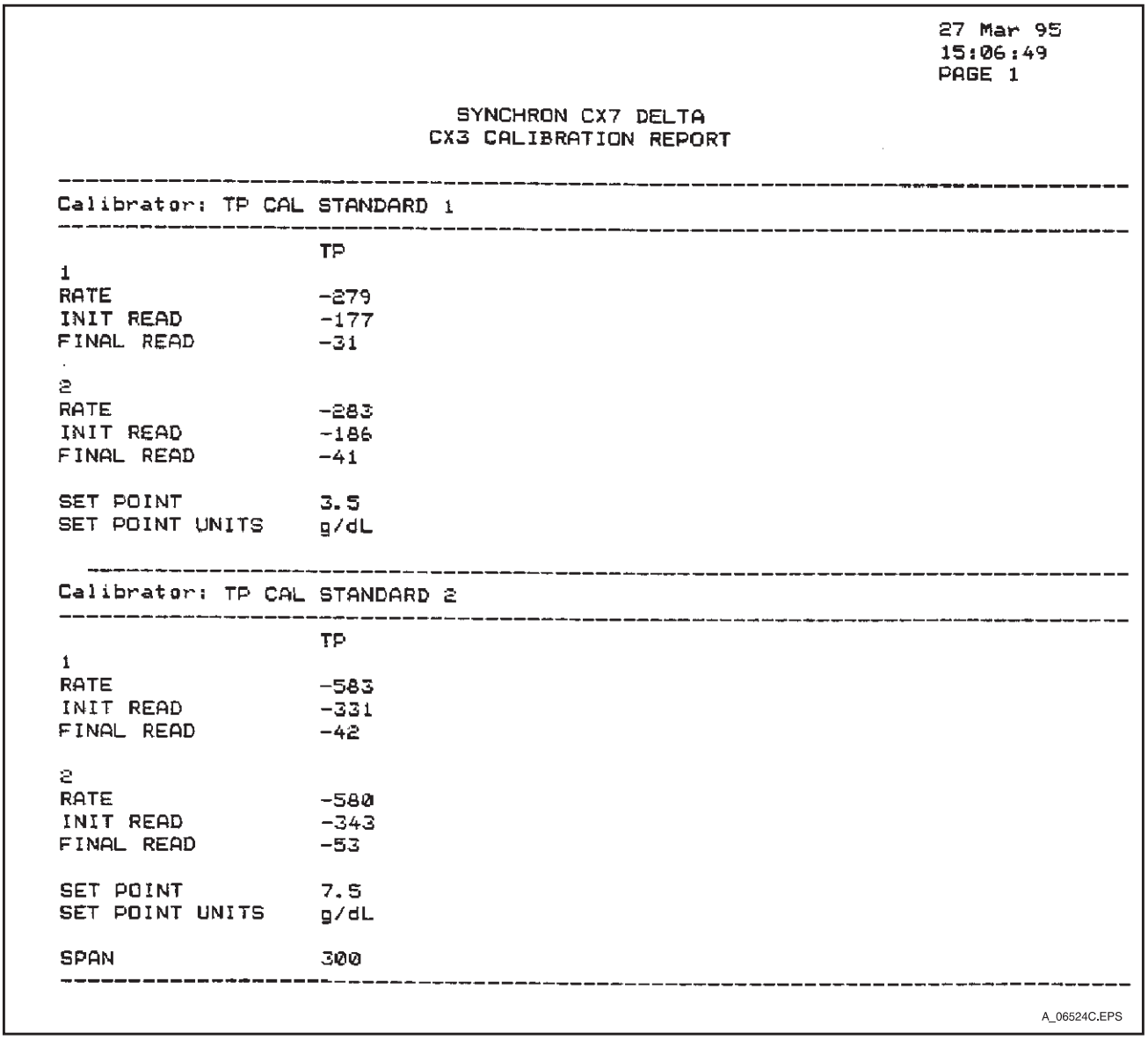
C

Figure 2-3. CX3 Calibration Report (CX7 users only) - Continued



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SYNCHRON CX7 DELTA
CX3 CALIBRATION REPORT

Calibrator: TP CAL STANDARD 1

	TP
1	
RATE	-279
INIT READ	-177
FINAL READ	-31
2	
RATE	-283
INIT READ	-186
FINAL READ	-41
SET POINT	3.5
SET POINT UNITS	g/dL

Calibrator: TP CAL STANDARD 2

	TP
1	
RATE	-583
INIT READ	-331
FINAL READ	-42
2	
RATE	-580
INIT READ	-343
FINAL READ	-53
SET POINT	7.5
SET POINT UNITS	g/dL
SPAN	300

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D

Figure 2-3. CX3 Calibration Report (CX7 users only) - Continued

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SYNCHRON CX5 DELTA
ISE CALIBRATION REPORT

Calibrator: CAL STANDARD 1

	NA	K	CL	CO2	CALC
1					
SMPL REFERENCE	469	28	-695	-230	69
SAMPLE	-1257	989	-496	-3441/-3312	-446
SMPL DEVIATION	1	1	1		0
REFERENCE	-1726	961	199	-3436/-3077	-515
REF DEVIATION	1	0	1		1
2					
SMPL REFERENCE	471	26	-704	-212	75
SAMPLE	-1254	987	-506	-3461/-3315	-441
SMPL DEVIATION	0	0	1		1
REFERENCE	-1725	961	198	-3445/-3087	-516
REF DEVIATION	1	1	0		0
3					
SMPL REFERENCE				-208	
SAMPLE				-3464/-3317	
SMPL DEVIATION					
REFERENCE				-3438/-3083	
REF DEVIATION					
SET POINT	100.0	4.00	20.0	0.0	5.0
SET POINT UNITS	mmol/L	mmol/L	mmol/L	mmol/L	mg/dL

Calibrator: CAL STANDARD 2

	NA	K	CL	CALC
1				
SMPL REFERENCE	-312	-573	204	-557
SAMPLE	-2049	385	480	-1077
SMPL DEVIATION	0	0	0	1
REFERENCE	-1737	958	276	-520
REF DEVIATION	1	0	2	0
2				
SMPL REFERENCE	-316	-574	210	-561
SAMPLE	-2052	383	492	-1078
SMPL DEVIATION	0	0	0	0
REFERENCE	-1736	957	282	-517
REF DEVIATION	1	1	1	1
SET POINT	180.0	10.00	180.0	14.0
SET POINT UNITS	mmol/L	mmol/L	mmol/L	mg/dL
SPAN	784	600	906	631

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Figure 2-4. ISE Module Calibration Report (CX5 users only)

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SYNCHRON CX5 DELTA
ISE CALIBRATION REPORT

Calibrator: CAL STANDARD 3

	NA	K	CL	CO2
1				
SMPL REFERENCE	1905	-2626	-52	479
SAMPLE	263	-1712	194	-3280/-2393
SMPL DEVIATION	2	0	0	
REFERENCE	-1642	914	246	-3410/-3002
REF DEVIATION	1	1	0	
2				
SMPL REFERENCE	1926	-2632	-50	481
SAMPLE	292	-1715	202	-3318/-2429
SMPL DEVIATION	2	0	1	
REFERENCE	-1634	917	252	-3416/-3008
REF DEVIATION	2	1	1	
SET POINT	20.0	180.00	100.0	30.0
SET POINT UNITS	mmol/L	mmol/L	mmol/L	mmol/L
SPAN	2229	2056	258	690

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B

Figure 2-4. ISE Module Calibration Report (CX5 users only) - Continued

Calibration Report Definitions

SAMPLE This is the average of four ADC readings associated with the measurement of the calibrator by the measuring electrode.

NOTE

Since CO_2 is a rate pH measurement, there are two readings: the first is the initial rate and the second is the final rate.

SMPL DEVIATION Each sample ADC (above) is actually an average of four readings. The ADC difference between these readings must be less than 15 counts or an Erratic ADC error will occur. This does not apply to CO_2.

REFERENCE This is the average of the four ADC readings corresponding to the measurement of the Electrolyte Reference Solution diluted with Electrolyte buffer reagent.

NOTE

Since CO_2 is a rate pH measurement, there are two readings: the first is the initial rate and the second is the final rate.

REF DEVIATION Each reference ADC (above) is actually an average of four readings. The ADC difference between these readings must be less than 15 counts or an Erratic ADC error will occur.

SAMPLE-REFERENCE The difference between the sample and reference ADC values. This is used for the back-to-back and span checks.

NOTE

For CO_2, the sample-reference is determined by first subtracting the initial rate from the final rate for both the sample and reference. The resulting two values are then subtracted from each other to obtain this value.

SPAN The average of the values reported for sample-reference for Cal 2 is subtracted from the average values of Cal 1, or the average of the values reported for sample-reference for Cal 3 is subtracted from the average values of Cal 2.

CONDITION In the event that an error occurred, an asterisk (*) will appear by the value which is out of specification. The corresponding error flag will be printed in this field. Only those errors that FAIL the calibration will be printed.

MAGNITUDE This is an indication of the severity of the failure. Depending on the error, the magnitude may reflect the actual value of the error or it may be the absolute difference between the limit and the actual value. Likewise, the magnitude may not be applicable to the error which has occurred. If this is the case, no value will appear under this field.

Table 2-5. Magnitude of Error (CX3/ISE) Chemistries

ERROR FLAG	MAGNITUDE
BACK TO BACK	absolute delta
OCR	absolute delta
ERRATIC ADC's	actual value
All others	no magnitude

2.3 CX4 SYMPTOMATIC TROUBLESHOOTING

2.3.1 Hardware and Software

SYMPTOM	CORRECTIVE ACTION
1. Air bubbles in sample or reagent syringe lines.	1. Prime the internal probe several times. 2. Check for loose or leaking fittings at 3-way valve. 3. Examine syringe tip for wear and replace if necessary.(Refer to Section 9 in the Operating Instructions manual.)
2. Fluid droplets on cuvette wash station probe tip.	1. Perform Cuvette Wash Test, Paragraph 3.8.2.5. 2. Replace check valve.
3. Ice or condensation build-up in refrigerator.	1. Check refrigerator temperature. 2. Verify refrigerator fan operation. 3. Call your local Beckman representative*.
4. Keyboard does not respond to input.	While system is in System Idle: 1. Reboot the system. 2. Call your local Beckman representative*.
5. Reagent probe does not detect reagent.	1. Perform Reagent Probe Height Adjustment procedure, Paragraph 3.6.10. 2. Call your local Beckman representative*.

SYMPTOM	CORRECTIVE ACTION
6. Reagent probe drips reagent.	1. Check for loose fittings, split or cracked lines. 2. Ensure there is DI water in the reagent syringe line. 3. Check for excessive syringe tip wear and replace if necessary. (Refer to Section 9 in the Operating Instructions manual.)
7. Refrigerator fan not operating.	1. Call your local Beckman representative*.
8. Sample probe does not clear the sample evaporation cover.	1. Verify correct sample evaporation cover placement. 2. Perform Sample Probe Alignment procedures, Paragraphs 3.5.7, 3.5.9 and 3.5.14.
9. Sample probe does not detect sample when sample is present.	1. Perform Sample Probe Height Adjustment procedure, Paragraph 3.5.14. 2. Perform Liquid Level Sense procedure, Paragraph 3.5.2.4.
10. Sample probe drips sample.	1. Check for loose fittings, split or cracked lines. 2. Ensure there is DI water in the sample syringe line. 3. Check for excessive syringe tip wear.
11. Sector read incorrectly.	1. Verify correct label placement on sector. 2. Perform Sector Read procedure, Paragraph 3.5.4.3.
12. Reagent Cartridge read incorrectly.	1. Bar code label must be clean, dry, unwrinkled and not faded or scratched. 2. Manually load reagent. Refer to Section 6 in the Operating Instructions.

2.3.2 Chemistry Performance

Poor chemistry performance may be exhibited in various ways: calibration failures, chemistry imprecision, high/low recovery, or nonlinearity. If a problem is suspected, the items listed below should be considered and systematically eliminated as potential causes of any performance deficiencies.

Reagent/Calibrator

PROBLEM	CORRECTIVE ACTION
1. Expired reagent	Replace reagent.
2. Incorrect or switched calibrator	Recalibrate with correct calibrators.
3. Expired calibrator	Use fresh calibrators.
4. Compromised reagent due to peltier failure or adverse shipping conditions	Use fresh reagent.

Reagent Handling

SYMPTOM	CORRECTIVE ACTION
1. Improper reagent probe alignment.	Perform diagnostics, Paragraphs 3.6.4, 3.6.6, and 3.6.10.
2. Improper reagent mixer alignment.	Perform diagnostics, Paragraphs 3.6.5, 3.6.7, and 3.6.11.
3. Reagent mixer does not spin.	Perform diagnostics, Paragraph 3.6.3.4.
4. Dirty reagent probe or mixer.	Perform maintenance, Section 9, in Operating Instructions.
5. Reagent bubbler not operating.	Perform diagnostics, Paragraph 3.8.3.3.

PROBLEM	CORRECTIVE ACTION
6. Dirty reagent probe or mixer.	Perform maintenance, Section 9, in Operating Instructions.
7. Reagent bubbler not operating.	Perform diagnostics, Paragraph 3.8.3.3.
8. Probe rinse solution bottle empty.	Fill bottle (refer to Section 9 in Operating Instructions.)
9. Reagent probe occluded.	Perform diagnostics, Paragraph 3.8.2.4.
10. Inoperable or occluded probe wash cup.	Perform diagnostics 3.8.2.3.
11. Reagent probe carryover.	Perform diagnostics, Paragraph 3.9.5.
12. Air bubbles in syringe line or reagent probe drips.	1. Prime the internal probe repeatedly. 2. Check for loose or leaking fittings at the 3-way valve. 3. Replace reagent syringe tip. (Refer to Section 9 in Operating Instructions.)
13. Improper reagent mixer speed.	Call your local Beckman representative* if suspected.

Sample Handling

PROBLEM	CORRECTIVE ACTION
1. Improper sample probe alignment.	Perform diagnostics, Paragraphs 3.5.7, 3.5.9, and 3.5.14.
2. Improper sample mixer alignment.	Perform diagnostics, Paragraphs 3.5.8, 3.5.10, and 3.5.15.
3. Sample mixer does not spin.	Perform diagnostics, Paragraph 3.5.3.4.

PROBLEM	CORRECTIVE ACTION
4. Dirty sample probe or mixer.	Perform maintenance, Section 9, in Operating Instructions.
5. Inoperable or occluded probe wash cup.	Perform diagnostics 3.8.2.3.
6. Sample probe carryover.	Perform diagnostics, Paragraph 3.9.5.
7. Air bubbles in syringe line.	1. Prime the internal probe repeatedly. 2. Check for loose or leaking fittings at the 3-way valve. 3. Replace sample syringe tip. (Refer to Section 9 in Operating Instructions.)
8. Improper sample mixer speed.	Call the Clinical Support Center, or your local Beckman Representative.*

Cuvette Wash

PROBLEM	CORRECTIVE ACTION
1. Inadequate vacuum to drain cuvette, fluid droplets at probe tip, or failure to fill cuvette.	1. Perform diagnostics, Paragraph 3.8.2.5 (3.7.3.2). 2. Perform diagnostics, Paragraph 3.11.4.
2. Cuvette wash probe wipers improperly seated.	Perform maintenance, Section 9, in Operating Instructions.
3. Occluded wash/rinse/vacuum probe.	Perform diagnostics, Paragraph 3.7.3.2.
4. Incorrect wash concentrate dilution.	Perform diagnostics, Paragraph 3.8.2.2.

Reaction Carousel

PROBLEM	CORRECTIVE ACTION
1. Operating temperature not properly set.	1. Perform diagnostics, Paragraph 3.4.2.1. 2. Contact your local Beckman representative*.
2. Bubbles in cuvettes.	1. Verify proper mixer alignment. (Refer to Paragraphs 3.5.3.2. and 3.6.3.2.) 2. Verify proper DI water temperature. 3. Clean cuvettes.
3. Broken cuvettes.	Replace (refer to Cuvette Replacement, Paragraph 4.5).

Photometric System

PROBLEM	CORRECTIVE ACTION
1. Improper flash delay.	Perform diagnostics, Paragraph 3.3.6.
2. Low lamp voltage.	Perform diagnostics, Paragraphs 3.3.7 and 3.3.8.
3. Photometer noise.	Perform diagnostics, Paragraph 3.9.2.
4. Bad lamp.	Call your local Beckman representative*.

Sample Integrity

PROBLEM	CORRECTIVE ACTION
1. Out of instrument range HI sample that is repeated in the ORDAC mode produces Out of Instrument Range ORDAC Low flag.	1. Check for sufficient reagent and wash solution. 2. Check for dirty sample probe. 3. Check for substance interference; repeat sample or manually dilute and repeat sample.

2.4 CX3/ISE MODULE SYMPTOMATIC TROUBLESHOOTING

2.4.1 Hardware

Reagent/Calibrator

SYMPTOM	CORRECTIVE ACTION
1. Air bubbles in reagent lines.	1. Prime all CX3/ISE chemistries 10 times. 2. Ensure dampers contain adequate reagent. (Refer to Section 9 in Operating Instructions.) 3. Check for loose fittings on ratio pump. 4. Check pinch valve adjustment. (Refer to Paragraph 3.11.4 or 3.14.3.) 5. Perform ratio pump maintenance. (Refer to Section 9 in Operating Instructions.)
2. Fluid around sample mixing cup base.	1. Perform electrolyte injection cup maintenance. (Refer to Section 9 in Operating Instructions.)
3. Poor sample probe alignment.	1. Perform sample probe alignment. (Refer to Paragraph 3.5.13, 3.11.2 or 3.14.2.)
4. Sample probe does not detect sample.	1. Verify cable connection on sample probe. 2. Perform sample probe maintenance. (Refer to Section 9 in Operating Instructions.)
5. Sample probe produces NO SAMPLE without going into the sample cup.	1. Perform sample probe maintenance. (Refer to Section 9 in Operating Instructions.)
6. Sample probe drips sample.	1. Check for air bubbles in sample probe and ratio pump tubing. 2. Trim line to top of sample probe. 3. Change sample probe. (Refer to Paragraph 4.21 or 4.34.) 4. Perform ratio pump maintenance. (Refer to Section 9 in Operating Instructions.)

2.4.2 CX3/ISE Chemistry Performance

The following table contains a listing of observed CX3/ISE malfunctions along with possible causes and actions recommended for the resolution.

SYMPTOM	CORRECTIVE ACTION
1. Failure to Calibrate	
(a) Erratic ADC's	CHECK FOR: 1. Pinched or blocked tubing. 2. Loose electrode connectors. 3. Loose solution ground. 4. No reagent. 5. Expansion bubble at face of sodium electrode (sodium failures only). 6. Defective sodium reference (sodium failures only). 7. Check for corrosion around electrode connector. 8. Check for bubbles in ratio pump cylinders 4 and 5. 9. Perform flow cell cleaning procedure.
(b) DAC ACCEPTABLE RANGE NA -1755 ±60 K 969 ±60 CL 307 ±60 CO_2 -3500 ±220 CALC (ISE) -542 ±60	1. Verify electrode connections. 2. Check electrode for damage. 3. Inspect for cracked insulation. 4. Verify reagent levels. 5. Inspect for corrosion. 6. Electrode connections reversed - ground wire disconnected. 7. Power system down and reseat CX3/ISE analog board. Power system up and recalibrate.

(c) Span

MINIMUM REQUIRED			
NA	350	(Cal 1 to 2)	1060 (Cal 2 to 3)
K	420	(Cal 1 to 2)	1100 (Cal 2 to 3)
CL	450	(Cal 1 to 2)	120 (Cal 2 to 3)
CO_2	450	(Cal 1 to 3)	
BUN3/URE3	700		
CA3	360		
CRE3	390		
GLU3	750		
CALC (ISE)	350		
TP3	(View calibrator acceptance limits)		

(ELECTROLYTES) CHECK FOR:

1. Reference and measuring cables switched.
2. Bad calibrators.
3. Switched calibrators.
4. Dirty flow cell.
5. Dirty ratio pump.
6. Defective ADC or Analog controller board.
7. Expansion bubble at face of electrode.
8. Deteriorated potassium tip.
9. Deteriorated chloride tip.
10. Ambient temperature not stable (CO_2 Drift).

(CX7 cup chems only)

1. Visibly check for:
   (a) Fresh calibrators.
   (b) Outdated or insufficient reagent.
   (c) Cracks or leaks in pump tubing or fittings.
   (d) Proper draining, filling and sipping of reaction cups.
   (e) Proper stirrer rotation.
   (f) Secure electrode, stirrer and heater connections.
   (g) Heater lamp LED's on intermittently for reaction cups.
   (h) Leaks around the flow ports.
2. Perform specific chemistry maintenance. (Section 9 of the Operating Instructions).
3. Perform electronic chemistry diagnostics (Paragraph 3.10).
4. Perform lamp test (Paragraph 4.23.1) if applicable and adjust potentiometers if necessary.

(d) Back to Back

MAXIMUM ALLOWED			
NA	15	(Cal 1,2)	75(Cal 3)
K	10		
CL	12		
CO_2	<5%		
BUN3	20	(Cal 1)	32(Cal 2)
CA3	10		
CRE3	16		
GLU3	24		
CALC (ISE)	10		
TP3	(View calibrator accept. limits)		

1. Switched reagent lines.
2. Plugged dampers/inline filters.
3. Pinch valve adjustment.
4. Solenoid not operating (CO_2).
5. Tubing in solenoid not secure or being pinched (CO_2).
6. Faulty CO_2 membrane (CO_2).
7. Smooth stirrer movement; inspect stirrer for chips or cracks.
8. Dirty sample probe.
9. Deteriorated potassium or calcium tip.
10. Deteriorated chloride tip.
11. Dirty flow cell.
12. Expansion bubble on either sodium electrode at electrode face.
13. Bubbles in ratio pump cylinders 4 and 5.
14. Ratio pump needs cleaning.

(e) All Calibration ADC's = 4095 or same ADC number on all Channels.

1. The CX3/ISE Analog board is suspected, call your local Beckman representative*.

(f) Calibration ADC's on one analyte = 4095.

1. Check electrode connections.
2. Look for bubbles in electrode face.

(g) NA, K, CL, CALC (ISE) Calibration ADC's all recover 4095.

1. Check reference electrode.

(h) CO_2 Calibration ADC's recover 4095.

1. Replace membrane.

(i) CA3 consistently requires 3 or more reps to calibrate.

1. Clean reagent lines and cup with bleach (Section 9 of the Operating Instructions).

2. High/Low recovery.

(a) Chloride

1. Perform chloride electrode tip maintenance.
2. Excessive Silicone Compound on chloride tip.
3. No reagents.

(b) Sodium	1. Expansion bubble at electrode face. 2. Measuring and reference electrodes switched. 3. Missing quad rings on electrode retainer ring.
(c) Potassium/CALC (ISE)	1. Replace potassium or calcium electrode tip.
(d) CO_2	1. Measuring and reference electrodes switched. 2. Ambient temperature not stable. 3. Expired Alkaline Buffer reagent.
(e) General	1. Expired reagent. 2. Sample probe maintenance. 3. Sample missing. 4. Cup maintenance. 5. Ratio pump maintenance.
3. Excessive Reference Drift for sodium when sample has a low sodium and a high potassium.	1. Repeat sample following a different sample than in previous run, or run sample in duplicate.
4. Excessive Reference Drift for chloride when difference between consecutive sample ADC numbers for reference is ≥ 200.	1. Repeat sample following a different sample than in previous run, or run sample in duplicate.
5. Excessive Reference Drift.	CHECK FOR: 1. Leaking damper. 2. Tubing crimped in solenoid. 3. Loose electrode connectors. 4. Acid shocking of electrode. 5. New electrode equilibration. 6. Instability from freshly cleaned flow cell. 7. Interfering substances. 8. Missing quad rings on electrodes. 9. Ambient temperature not stable (CO_2 drift).

6. Imprecision in one or more chemistries.	CHECK FOR: 1. Check filling, sipping and draining of chemistry cups. Replace peri-pump tubing if necessary (CX3 only). 2. Switched reagent lines. 3. Pinch valve adjustment. 4. Plugged dampers/inline filters. 5. Solenoid not operating (CO_2). 6. Tubing in solenoid not secure or being pinched (CO_2). 7. Faulty CO_2 membrane (CO_2). 8. Deteriorated potassium tip. 9. Deteriorated chloride tip. 10. Dirty flow cell. 11. Expansion bubble on either sodium electrode at electrode face. 12. Bubbles in ratio pump cylinders 4 and 5. 13. Dirty sample probe. 14. Ratio pump needs cleaning. 15. Deteriorated calcium tip.
7. Sodium not run due to Calibration Required error flag and sodium is calibrated.	CHECK FOR: 1. Calibrate potassium. (Refer to the Operating Instructions manual, Section 6).
8. Serum calcium not run due to Calibration Required error flag and calcium is calibrated.	1. Calibrate sodium and/or chloride. (Refer to the Operating Instructions manual, Section 6).
9. Urine calcium not run due to Calibration Required error flag and calcium is calibrated.	1. Calibrate sodium and/or potassium. (Refer to the Operating Instructions manual, Section 6).

2.5 STATUS MONITOR ERRORS

2.5.1 CX4 Status Monitor

The STATUS MONITOR records the functional status of various parameters. Any value that is outside the acceptable specifications will display in red on the screen indicating an error condition.

SPECIFICATION	CORRECTIVE ACTION
P.S. No. 1	
+12V +5V 'A/B'-12V +24V 'B' +15 (dc-dc) -15 (dc-dc)	Check LED on front instrument panel and call your local Beckman representative*.
P.S. No. 2	
+15V +24V 'A' 15	Check LED on front instrument panel and call your local Beckman representative *.
P.S. No. 3	
+12V 'M' +5V 'M' +38V 'M'	Check LED on front instrument panel and call your local Beckman representative *.
TEMPERATURES (° C)	
Carousel: set temp ±0.1	Perform Reaction Carousel Heater diagnostics, Paragraph 3.4.2.
Wash: set temp ±5.0	Perform Cuvette Wash Heater diagnostics, Paragraph 3.4.3.
Rinse: set temp ±5.0	Perform Cuvette Rinse Heater diagnostics, Paragraph 3.4.4.
Peltier: 1.8 to 3.3°C	Verify reagent carousel fan operation. Perform Reagent Refrigerator Peltier diagnostics, Paragraph 3.4.5.
Cool Air: 15 to 42°C	Verify system compartment fan operation.

FLUID LEVELS

Fluid levels are reported as "FULL", "OK", or "FAIL". The status of "OK" indicates a volume between empty and full. A "FAIL" status indicates an empty container.

If fluid levels do not agree with the reported levels perform the following diagnostic sections:

Wash Bottle #1	Diagnostic Paragraph 3.8.2.2
Wash Bottle # 2	Diagnostic Paragraph 3.8.2.2
Conc or Rinse	Diagnostic Paragraph 3.8.2.2
Vac. Liquid Trap	Diagnostic Paragraph 3.8.4.1 Diagnostic Paragraph 3.8.4.3
Sump Waste Level	Diagnostic Paragraph 3.8.4.2
DI Water Level	Call your local Beckman representative*

SPECIFICATION	CORRECTIVE ACTION

DI WATER PURITY

DI water purity is measured by a sensor in the hydropneumatic assembly as “OK” or “BAD”.

If the DI water purity is registered as “BAD”

1. Prime the INTERNAL PROBE WASH.
2. Verify DI water source meets NCCLS TYPE II perform the following requirements.
3. The purity sensor is suspected, call your local Beckman representative *.

PRESSURE/VACUUM

The air pressure, DI water pressure, rinse pressure and vacuum levels on the SYNCHRON CX4 are recorded as “OK”, “HIGH” or “LOW”.

If a status of “LOW” or “HIGH” appears for any of the pressurized containers, perform the following:

1. Verify pressure gauge and adjust if necessary (refer to the Operating Instructions manual, Section 9):

HIGH AIR	25.0 psi	±1.0
LOW AIR	5.0 psi	±0.5
VACUUM	27.0 in Hg	Minimum
DI WATER	10.0 psi	±0.5

2. If a pressure gauge does not adjust, perform Pneumatic diagnostic routines, Paragraph 3.8.3.

2.5.2 CX3 Status Monitor (CX7 DELTA Only)

The STATUS MONITOR records the functional status of various parameters of the CX3.

Any value that is outside the acceptable specifications will display in red on the screen indicating an error condition.

SPECIFICATION			CORRECTIVE ACTION
POWER SUPPLY 2			
+5V	+15V		Call your local Beckman representative*.
+5V	+24V	"M"	
+12V	+12V	"M"	
-12V	+ 5V	"M"	
+5V (dc-dc)			
+15V (dc-dc)			
-15V (dc-dc)			
POWER SUPPLY 1			
+15V			Call your local Beckman representative*.
+24V			
-12V			
+15V			
-15V			
DC/DC SUPPLIES			
+5V (dc-dc)			Call your local Beckman representative*.
+5V (dc-dc)			
+15V (dc-dc)			
-15V (dc-dc)			
PERI-PUMP POWER SUPPLY			
24 Vac (avg)			Call your local Beckman representative*.

* Contact the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

2.5.3 CX3 Status Monitor (CX7 Only)

The CX3 STATUS MONITOR records the functional status of various parameters of the CX3 module.

Any value that is outside the acceptable specifications will display in red on the screen indicating an error condition.

SPECIFICATION	CORRECTIVE ACTION
POWER SUPPLY 4	
+15 -15 +5V	Call your local Beckman representative*.
+24V	Check LED on front instrument panel and call your local Beckman office*.
POWER SUPPLY 2	
+5V -5V +12V -12V +5V (dc-dc) +15V (dc-dc) -15V (dc-dc)	Call your local Beckman representative*.
POWER SUPPLY 5	
+13V	Call your local Beckman representative*.
POWER SUPPLY 1	
+17V	Call your local Beckman representative*.
FREQUENCY CONVERTER	
24VAC	Call your local Beckman representative*.

* Contact the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

2.5.4 ISE Module Status Monitor (CX5 Users Only)

The ISE STATUS MONITOR records the functional status of various parameters of the ISE module. Any value that is outside the acceptable specifications will display in red on the screen indicating an error condition.

SPECIFICATION	CORRECTIVE ACTION
ANALOG SUPPLY	
+15	Call your local Beckman representative*.
-15	
LOGIC SUPPLY	
+5V	Call your local Beckman representative*.
-5V	
STP. MTR	
+13V	Call your local Beckman representative*.
FREQUENCY CONVERTER	
24V	Call your local Beckman representative*.

* Contact the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

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Section 3
DIAGNOSTIC FUNCTIONAL AREAS

This section provides information for the use of the SYNCHRON CX4, CX5, and CX7 Diagnostic software routines for diagnosing and correcting malfunctions encountered during system operation. A detailed description of the software functions, their access, and results are discussed in the following sections for ease of operation.

DIAGNOSTIC FUNCTIONAL AREAS

3.1 CX4 CPU System
3.2 CX4 Motion Control System
3.3 CX4 Analog Control System
3.4 CX4 Temperature Control System
3.5 CX4 Sample System
3.6 CX4 Reagent System
3.7 CX4 Reaction Carousel System
3.8 CX4 Hydropneumatic System
3.9 CX4 Performance Verification
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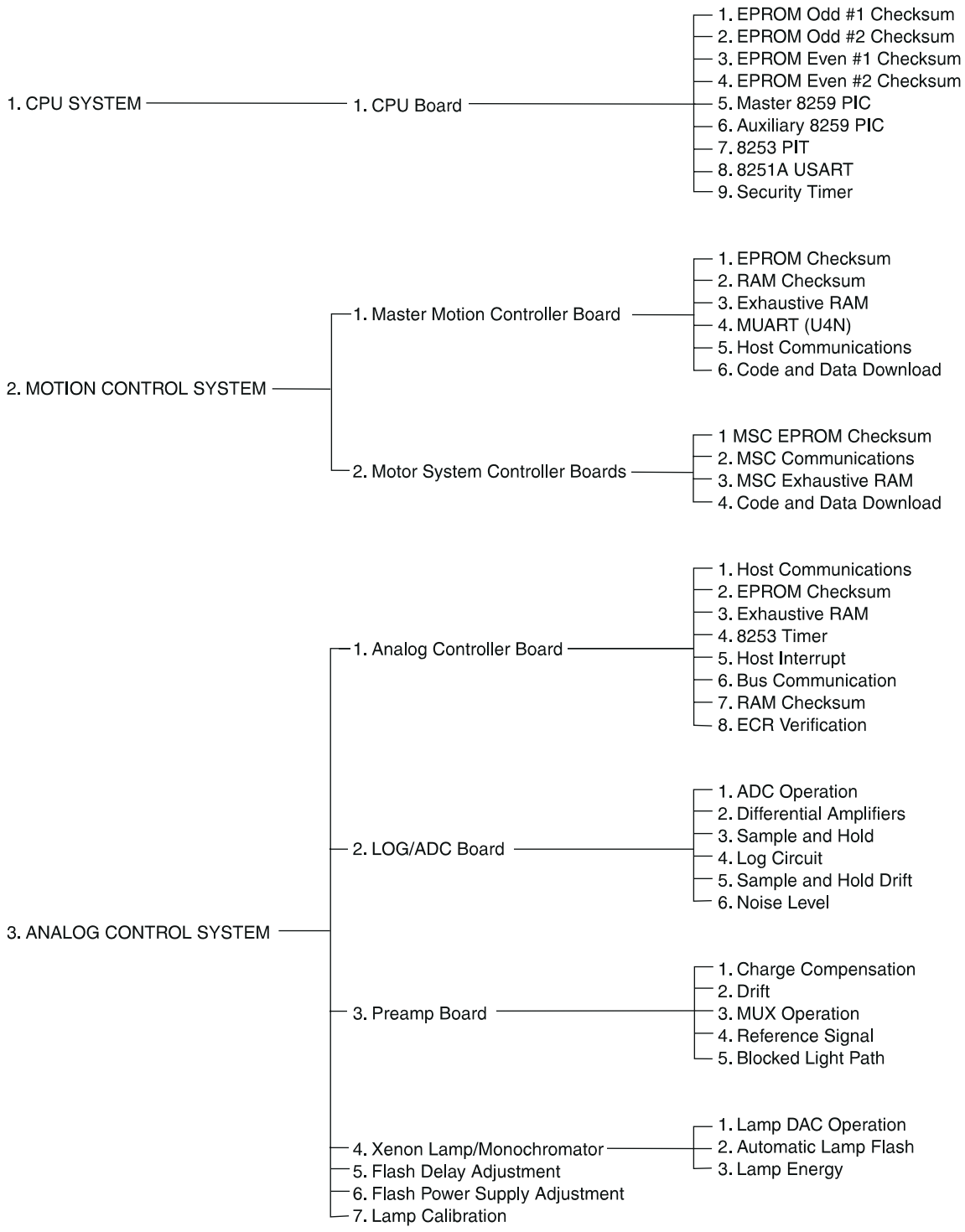
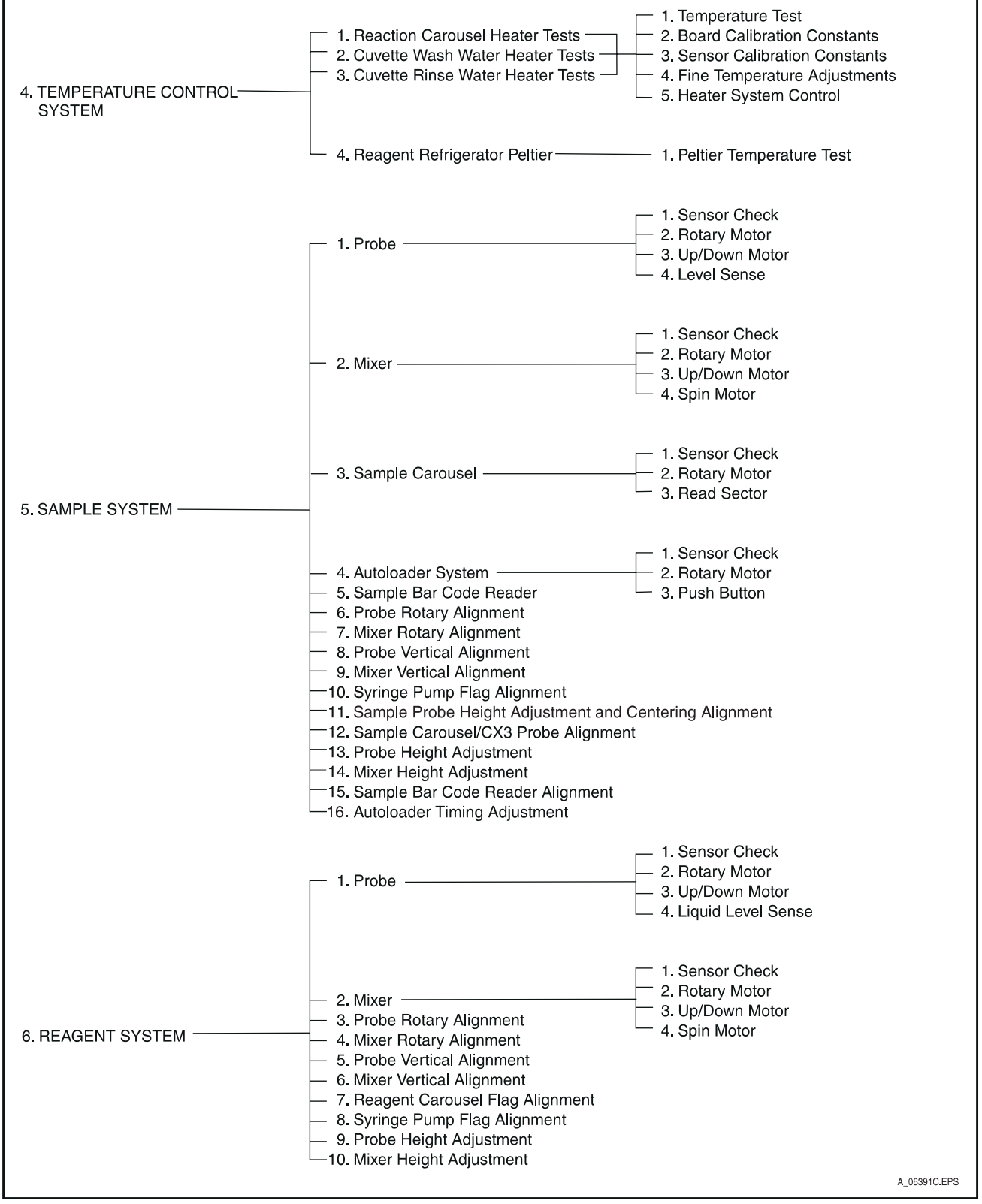
3.11 CX3 Mechanical Tests
3.13 ISE Electronic Tests
3.14 ISE Mechanical Tests

A flow diagram illustrating access to various functional areas follows on the following five pages.

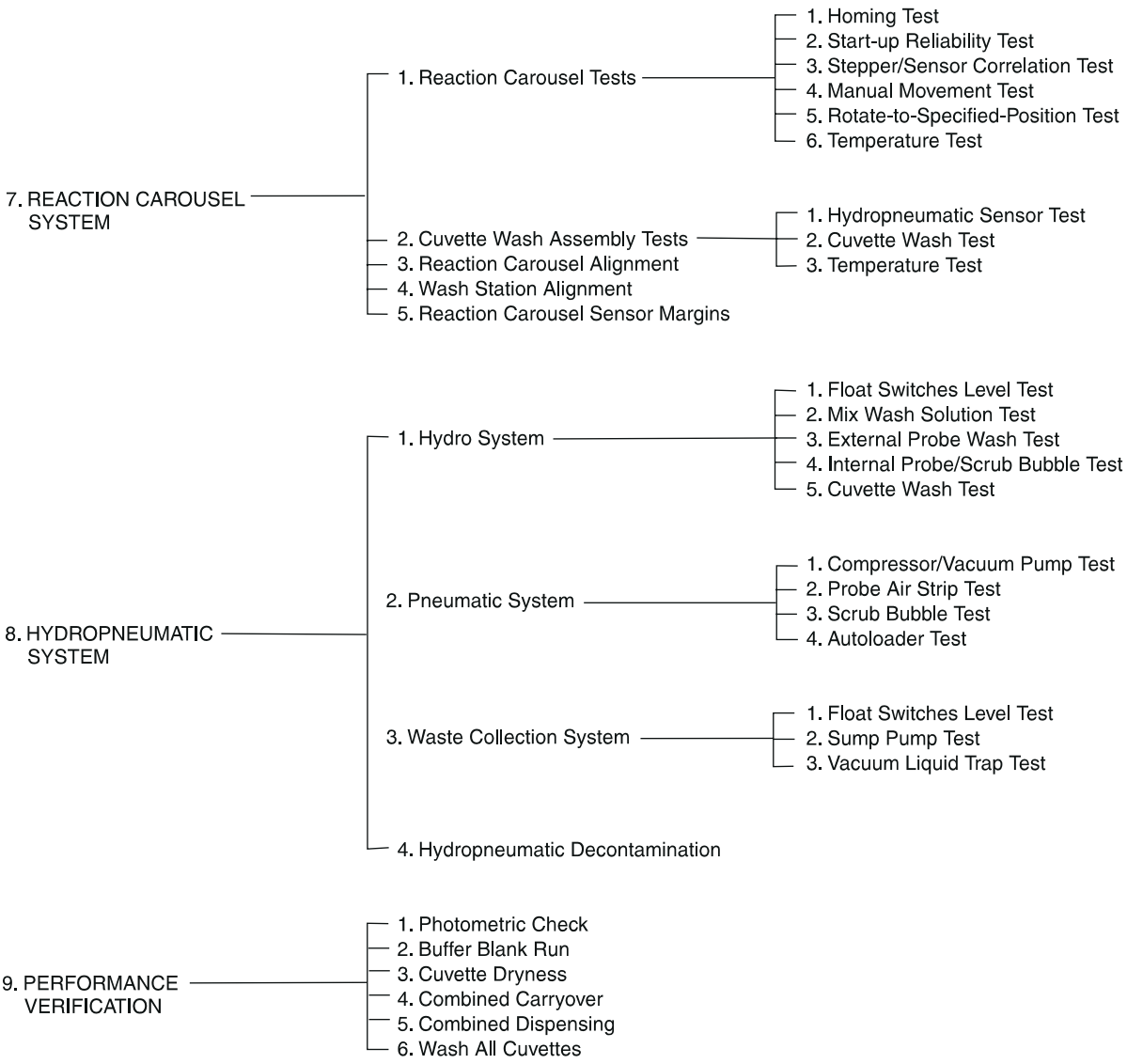
CX4 DIAGNOSTIC FUNCTIONAL AREAS



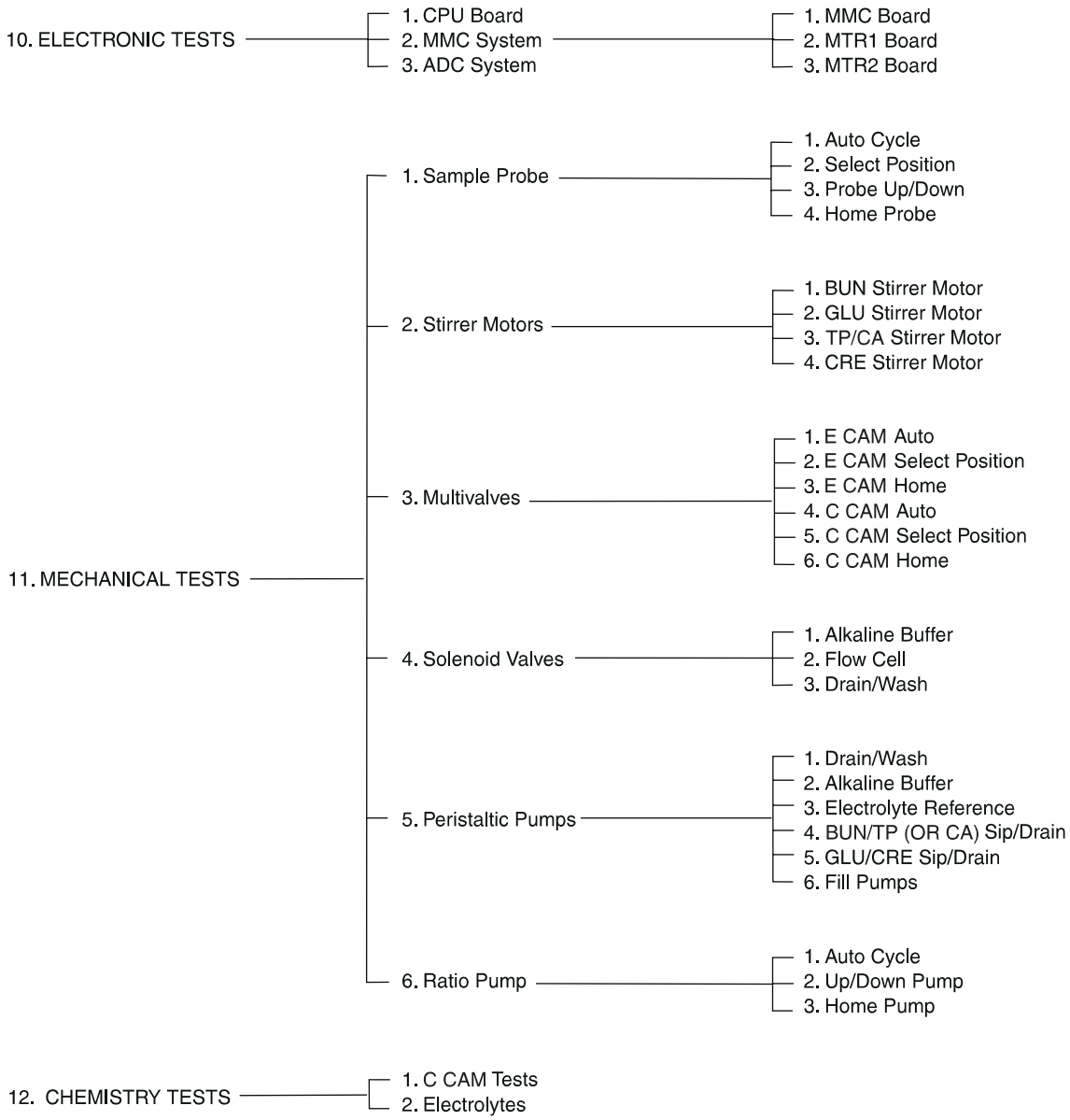
CX4 DIAGNOSTIC FUNCTIONAL AREAS (Continued)



CX4 DIAGNOSTIC FUNCTIONAL AREAS (Continued)



CX3 DIAGNOSTIC FUNCTIONAL AREAS

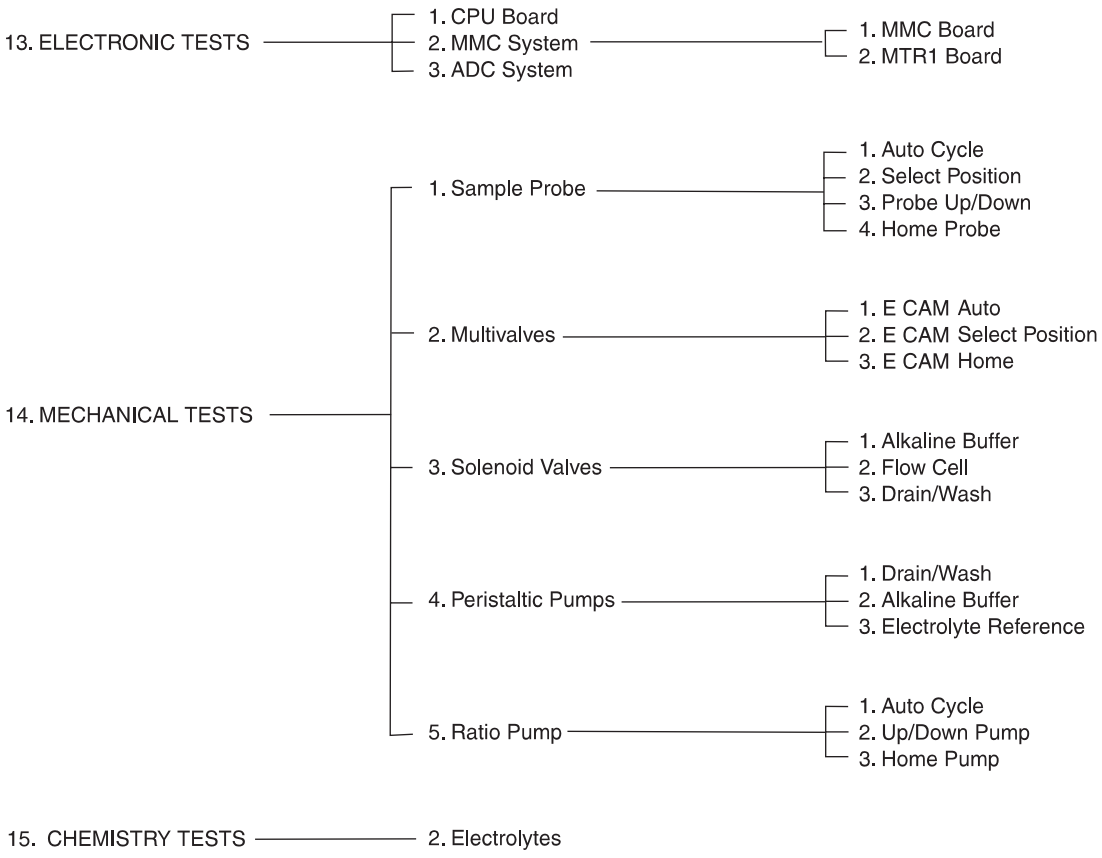


NOTE

The Chemistry Tests are unavailable at this time.

A_06393C.EPS

ISE DIAGNOSTIC FUNCTIONAL AREAS



NOTE

The Chemistry Tests are unavailable at this time.

A_06394C.EPS

When a test result indicates a board malfunction, refer to Figures 3-1, 3-2, and 3-3 and to Appendix C for board location and LED description.

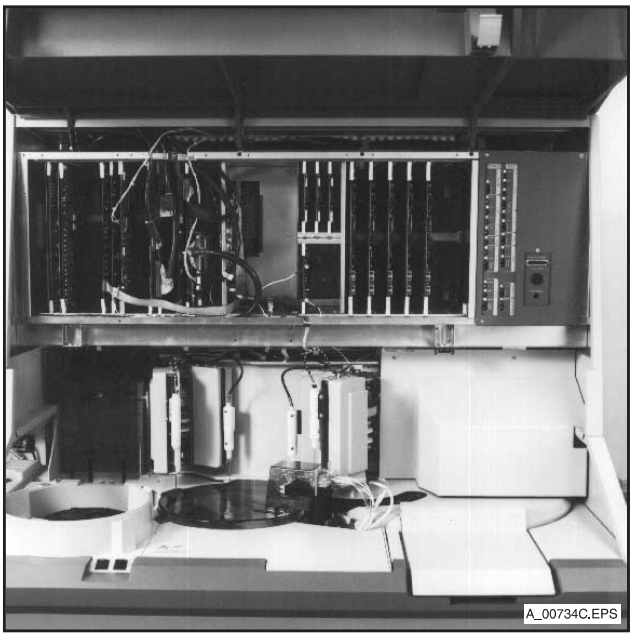


Figure 3-1. CX4 Boards

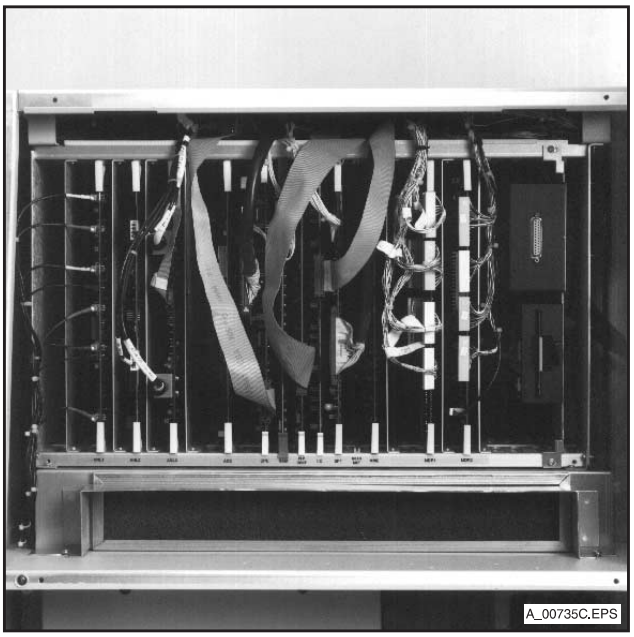


Figure 3-2. CX3 Boards

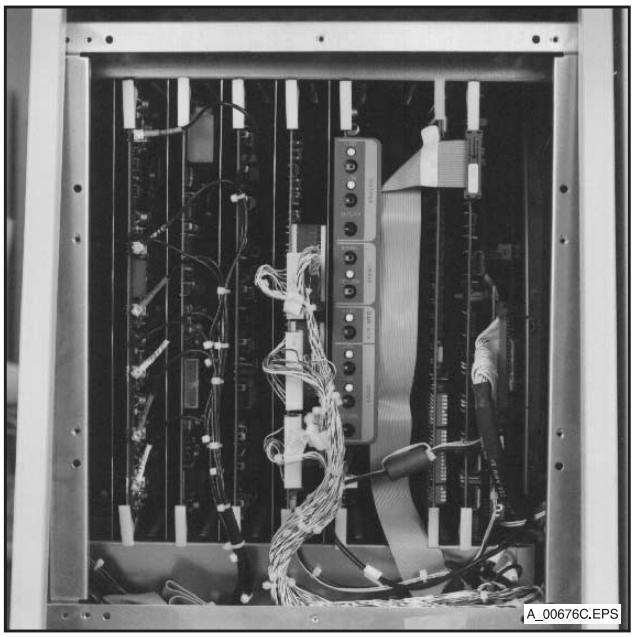


Figure 3-3. ISE Boards

3.1 CX4 CPU SYSTEM

3.1.1 DESCRIPTION

The CPU System functional area exercises the Central Processing Unit (CPU) Board to verify correct operation. The CPU Board is the main computer board of the instrument. It coordinates all instrument motion, interfaces with the user through the a data console and calculates answers to all chemistry tests. The Memory Board provides up to four megabytes of random access memory (RAM), which is used for storage and retrieval of operating program information and other pertinent data.

NOTE

PRIMARY Mode test should be run prior to any test in the EXTENDED Mode. All PRIMARY Mode failures should be confirmed through EXTENDED Mode testing.

Performing the CPU System PRIMARY Mode diagnostic test will result in a checksum error being displayed. No action is required. The message may be cleared by pressing the PREV SCREEN key.

If an MMC Communications error occurs during the CPU System PRIMARY Mode tests, perform Code and Data Download procedure. (Refer to Paragraph 3.2.2.6 for instructions.)

3.1.1.1 Error Conditions

No response from the keyboard.

3.1.1.2 Module

The following module is tested under the CPU SYSTEM functional area:

CPU Board

3.1.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
CPU Board	3.1.2	
EPROM Odd #1 Checksum	3.1.2.2	Primary, Extended
EPROM Odd #2 Checksum	3.1.2.3	Primary, Extended
EPROM Even #1 Checksum	3.1.2.4	Primary, Extended
EPROM Even #2 Checksum	3.1.2.5	Primary, Extended
Master 8259 PIC	3.1.2.6	Primary, Extended
Auxiliary 8259 PIC	3.1.2.7	Primary, Extended
8253 PIT	3.1.2.8	Primary, Extended
8251A USART	3.1.2.9	Primary, Extended
Security Timer	3.1.2.10	Primary, Extended

3.1.2 CX4 CPU BOARD

3.1.2.1 All CPU Board Tests

1. Test Summary. This option performs all CPU Board tests.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** item 1. CPU System, or type 1, **ENTER**.
   (e) Cursor and **SELECT** item 10. All CPU Board Tests, or type 10, **ENTER**.
4. Corrective Action. If any of the CPU Board tests fail, refer to the section below for that specific test.

3.1.2.2 EPROM Odd #1 Checksum

1. Test Summary. The EPROM Odd #1 Checksum test performs a summation of the contents of the memory locations in the Erasable, Programmable, Read Only Memory (EPROM) #1 and compares the odd checksum with the value stored in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.
   (e) Cursor and **SELECT** item 1. EPROM Odd #1 Checksum or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the EPROM Odd #1 Checksum test. If the test fails again, continue to the next corrective action step.

(a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

(b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.3 EPROM Odd #2 Checksum

1. Test Summary. The EPROM Odd #2 Checksum test performs a summation of the contents of the memory locations in the Erasable, Programmable, Read Only Memory (EPROM) #2 and compares the odd checksum with the value stored in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** item 1. CPU System, or type 1, **ENTER**.
   (e) Cursor and **SELECT** item 2. EPROM Odd #2 Checksum, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the EPROM Odd # 2 Checksum test. If the test fails again, continue to the next corrective action step.
   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.4 EPROM Even #1 Checksum

1. Test Summary. The EPROM Even #1 Checksum test performs a summation of the contents of the memory locations in the Erasable, Programmable, Read Only Memory (EPROM) #1 and compares the even checksum with the value stored in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.
   (e) Cursor and **SELECT** item 3. EPROM Even #1 Checksum or type 3, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the EPROM Even #1 Checksum test. If the test fails again, continue to the next corrective action step.
   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.5 EPROM Even #2 Checksum

1. Test Summary. The EPROM Even #2 Checksum test performs a summation of the contents of the memory locations in the Erasable, Programmable, Read Only Memory (EPROM) #2 and compares the even checksum with the value stored in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.

(e) Cursor and **SELECT** item 4. EPROM Even #2 Checksum or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the EPROM Even #2 Checksum test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.6 Master 8259 PIC

1. Test Summary. This test exercises the master Programmable Interrupt Controller (PIC) to verify its ability to define system high priority interrupt conditions.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.

   (e) Cursor and **SELECT** item 5. Master 8259 PIC or type 5, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Master 8259 PIC test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.7 Auxiliary 8259 PIC

1. Test Summary. This test exercises the auxiliary Programmable Interrupt Controller to verify its ability to define system high priority interrupt conditions.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.

   (e) Cursor and **SELECT** item 6. Auxiliary 8259 PIC or type 6, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Auxiliary 8259 PIC test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.8 8253 PIT

1. Test Summary. This test exercises the Programmable Interrupt Timer (PIT) to verify that a timing interrupt occurs during a test countdown.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.

(e) Cursor and **SELECT** item 7. 8253 PIT, or type 7, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the 8253 PIT test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.9 8251A USART

1. Test Summary. This test exercises the Universal Synchronous, Asynchronous, Receive and Transmit (USART) chip to verify that the transmit ready line becomes active when a status is read.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.

   (e) Cursor and **SELECT** item 8. 8251A USART, or type 8, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the 8251A USART test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.1.2.10 Security Timer

1. Test Summary. The Security Timer test validates the operation of the security timer by setting the timer to a specified time interval to be counted down. The test fails if the security timer does not get set when directed or if it does not count down.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** item 1. CPU System or type 1, **ENTER**.

   (e) Cursor and **SELECT** item 9. Security Timer, or type 9, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Security Timer test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected, call the Clinical Support Center or your local Beckman representative.

3.2 CX4 MOTION CONTROL SYSTEM

3.2.1 DESCRIPTION

The Motion Control System functional area verifies correct operation of the Master Motion Controller Board and the five Motion System Controller Boards. These boards are responsible for controlling all movement for reagent and sample dispensing and mixing; reagent, sample and reaction carousel rotation; sample loader rotation and cuvette wash station.

3.2.1.1 Error Conditions

Reagent and Sample Probe and Mixer motion errors
Sample Carousel motion errors
Reaction Carousel motion errors

3.2.1.2 Modules

The following modules are tested under the MOTION CONTROL SYSTEM functional area:

Master Motion Controller Board
Motor System Controller Boards

3.2.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Master Motion Controller Board	3.2.2	
EPROM Checksum	3.2.2.1	Primary, Extended
RAM Checksum	3.2.2.2	Extended
Exhaustive RAM	3.2.2.3	Extended
MUART (U4N)	3.2.2.4	Primary, Extended
HOST Communications	3.2.2.5	Primary, Extended
Code and Data Download	3.2.2.6	Extended
Motor System Controller Boards	3.2.3	
MSC EPROM Checksum	3.2.3.1	Primary, Extended
MSC Communications	3.2.3.2	Primary, Extended
MSC Exhaustive RAM	3.2.3.3	Primary, Extended
Code and Data Download	3.2.3.4	Primary, Extended

3.2.2 CX4 MASTER MOTION CONTROLLER BOARD

The Master Motion Controller (MMC) Board interfaces the CPU to the five Motor System Controller (MSC) Boards. On command from the CPU, the MMC Board forms the overall motion scheme, breaking the motion into individual motor commands and disseminating the motor commands to the individual motor system boards.

3.2.2.1 EPROM Checksum

1. Test Summary. The EPROM Checksum test performs a summation of the contents of the memory locations in the Erasable, Programmable, Read Only Memory (EPROM) and compares the checksum with the value stored in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.
   (e) Cursor and **SELECT** 1. Master Motion Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 1. EPROM Checksum or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the EPROM Checksum test. If the test fails again, continue to the next corrective action step.
   (a) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (b) The Master Motion Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.2.2 RAM Checksum

Test not available at this time; call the Clinical Support Center or your local Beckman representative.

3.2.2.3 Exhaustive RAM

1. Test Summary. The Exhaustive RAM test verifies the ability of the Master Motion Controller Board to retain data.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.
   (e) Cursor and **SELECT** 1. Master Motion Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 3. Exhaustive RAM or type 3, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Exhaustive RAM test. If the test fails again, continue to the next corrective action step.

(a) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

(b) The Master Motion Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.2.4 MUART (U4N)

1. Test Summary. The Multipurpose Universal Asynchronous Receive and Transmit (MUART) test verifies the correct operation of the interrupt controller, timers, and serial input/output channels.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.
   (e) Cursor and **SELECT** 1. Master Motion Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 4. MUART (U4N) or type 4, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MUART (U4N) test. If the test fails again, continue to the next corrective action step.
   (a) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (b) Perform other Master Motion Controller Board tests (Paragraph 3.2.2) to verify correct operation of MMC.
   (c) The Master Motion Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.2.5 Host Communications

1. Test Summary. The Host Communications test verifies communication between the CPU Board and the Master Motion Controller Board.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.
   (e) Cursor and **SELECT** 1. Master Motion Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 5. HOST Communications or type 5, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Host Communication test. If the test fails again, continue to the next corrective action step.
   (a) Perform CPU Board diagnostics to verify correct operation of the CPU system (refer to Paragraph 3.1.2).
   (b) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (c) The Master Motion Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.2.6 Code and Data Download

1. Test Summary. The Code and Data Download procedure sends software code from the host CPU to the Master Motion Controller (MMC) Board. This procedure is useful in the event that code was lost due to a communication error. The procedure fails if a checksum error occurs during the code and data download process.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.

   (e) Cursor and **SELECT** 1. Master Motion Controller Board or type 1, **ENTER**.

   (f) Cursor and **SELECT** 6. Code and Data Download or type 6, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Code and Data Download test. If the test fails again, continue to the next corrective action step.

   (a) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The Master Motion Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.3 CX4 MOTOR SYSTEM CONTROLLER BOARDS

The five Motor System Controller (MSC) Boards receive instructions from the Master Motion Controller (MMC) Board and provide the control needed to drive the various stepper motors and solenoid valves used in the system. These five MSC Boards are identical in construction and are therefore interchangeable.

3.2.3.1 MSC EPROM Checksum

1. Test Summary. The MSC EPROM Checksum test performs a summation of the contents of the memory locations in the Motor System Controller Erasable, Programmable, Read Only Memory (EPROM) and compares the checksum with the value stored in memory.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.

   (e) Cursor and **SELECT** 2. Motor System Controller Boards or type 2, **ENTER**.

   (f) Cursor and **SELECT** 1. MSC EPROM Checksum or type 1, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MSC EPROM Checksum test. If the test fails again, continue to the next corrective action step.

   (a) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The Motor System Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.3.2 MSC Communications

1. Test Summary. The MSC Communications test verifies communication between the Motor System Controller Boards and the Master Motion Controller Board.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.

   (e) Cursor and **SELECT** 2. Motor System Controller Boards or type 2, **ENTER**.

   (f) Cursor and **SELECT** 2. MSC Communications or type 2, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MSC Communications test. If the test fails again, continue to the next corrective action step.

   (a) Perform all MSC Board diagnostics (Paragraph 3.2.3) to verify correct operation of MSC Boards.

   (b) If all MSC Boards fail, the Master Motion Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.3.3 MSC Exhaustive RAM

1. Test Summary. The MSC Exhaustive RAM test verifies the ability of the Motor System Controller Boards to retain data.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.

   (e) Cursor and **SELECT** 2. Motor System Controller Boards or type 2, **ENTER**.

   (f) Cursor and **SELECT** 3. MSC Exhaustive RAM or type 3, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MSC Exhaustive RAM test. If the test fails again, continue to the next corrective action step.

   (a) Place the Master Motion Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The Motor System Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.2.3.4 Code and Data Download

1. Test Summary. The Code and Data Download procedure sends software code to the five Motor System Controller Boards in the event of a communication error. A failure will result if a checksum error or a timeout occurs while waiting for a response from the MSC Board.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 2. Motion Control System or type 2, **ENTER**.

   (e) Cursor and **SELECT** 2. Motor System Controller Boards or type 2, **ENTER**.

   (f) Cursor and **SELECT** 4. Code and data download or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Code and Data Download test. If the test fails again, continue to the next corrective action step.

   (a) Place the Motor System Controller Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The Motor System Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3 CX4 ANALOG CONTROL SYSTEM

3.3.1 DESCRIPTION

The Analog Control functional area tests the operation of four major components: the Analog Control Board, the LOG/ADC Board, the Preamp Boards, and the Xenon Lamp/Monochromator. The Analog Control System also synchronizes the lamp flash sequence, sets the lamp output energy, and develops the lamp extinction coefficients.

NOTE

PRIMARY Mode tests should be run prior to any test in the EXTENDED Mode. If all PRIMARY Mode tests pass, refer to Paragraph 3.3.1.3 for additional EXTENDED Mode tests to be run. All PRIMARY Mode failures should be confirmed through EXTENDED Mode testing.

3.3.1.1 Error Conditions

The following conditions may be associated with this module:

All Cuvettes Replaced
New Reaction Carousel
Repositioning Reaction Carousel Sensors
Removing/Installing the Same Carousel
Repositioning or Installing Lamp
Nonlinear chemistry recovery
Low or high chemistry recovery

3.3.1.2 Modules

The following modules are tested in the Analog Control functional area:

PRIMARY MODE

Analog Controller
LOG/ADC Board
Preamp Board
Xenon Lamp/Monochromator

EXTENDED MODE

Analog Controller Board
LOG/ADC Board
Preamp Boards
Xenon Lamp/Monochromator

ALIGNMENT MODE

Flash Power Adjustment
Flash Delay Adjustment
Lamp Calibration

3.3.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Analog Controller Board	3.3.2	
Host Communication	3.3.2.2	Primary, Extended
EPROM Checksum	3.3.2.3	Primary, Extended
Exhaustive RAM	3.3.2.4	Primary, Extended
8253 Timer	3.3.2.5	Primary, Extended
Host Interrupt	3.3.2.6	Primary, Extended
Bus Communication	3.3.2.7	Primary, Extended
RAM Checksum	3.3.2.8	Primary, Extended
ECR Verification	3.3.2.9	Primary, Extended
LOG/ADC Board	3.3.3	
ADC Operation	3.3.3.2	Extended
Differential Amplifiers	3.3.3.3	Extended
Sample and Hold	3.3.3.4	Extended
LOG Circuit	3.3.3.5	Extended
Sample and Hold Drift	3.3.3.6	Extended
Noise Level	3.3.3.7	Primary, Extended
Preamp Boards	3.3.4	
Charge Compensation	3.3.4.2	Extended
Drift	3.3.4.3	Extended
MUX Operation	3.3.4.4	Primary, Extended
Reference Signal	3.3.4.5	Extended
Blocked Light Path	3.3.4.6	Primary, Extended
Xenon Lamp/Monochromator	3.3.5	
Lamp DAC Operation	3.3.5.1	Primary, Extended
Automatic Lamp Flash	3.3.5.2	Extended
Lamp Energy	3.3.5.3	Extended
Flash Delay Adjustment	3.3.6	Alignment
Flash Power Supply Adjustment	3.3.7	Alignment
Lamp Calibration	3.3.8	Alignment

3.3.2 CX4 ANALOG CONTROLLER BOARD

The Master Analog Controller (MAC) Board accepts commands and data from the CPU. It is responsible for controlling the analog to digital conversion process, and measuring and transmitting reduced data to the CPU Board. This multi-function board provides digital to analog circuitry for the xenon lamp power supply, the reagent bar code reader circuitry and circuitry for the various sensors.

3.3.2.1 All Analog Controller Board Tests

1. Test Summary. This option performs all analog controller board tests.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 1. Analog Controller Board, or type 1, **ENTER**.

(f) Cursor and **SELECT** 9. All Analog Controller Tests, or type 9, **ENTER**.

4. Corrective Action. If any Analog Controller Board tests fail, refer to the section below for that specific test.

3.3.2.2 Host Communication

1. Test Summary. The Host Communication test verifies the CPU Board and Analog Board communication.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.
   (e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 1. Host Communication or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Host Communication test. If the test fails again, continue to the next corrective action step.
   (a) Repeat the Host Communication test with replicates set to 10. To set replicates to 10, refer to Paragraph 1.1.1.2.
   (b) Perform CPU Board diagnostics, Paragraph 3.1.2.
   (c) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram an d Paragraph 4.4 for procedure on removing board).
   (d) The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.3 EPROM Checksum

1. Test Summary. The EPROM Checksum test performs a summation of the contents of the memory locations in the EPROM chip and compares it with the value in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.
   (e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 2. EPROM Checksum or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the EPROM Checksum test. If the test fails again, continue to the next corrective action step.
   (a) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram an d Paragraph 4.4 for procedure on removing board).
   (b) The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.4 Exhaustive RAM

1. Test Summary. The Exhaustive Random Access Memory (RAM) test verifies ability of the 16 Analog Controller Board RAM chips to retain data.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.

(c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.

(e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.

(f) Cursor and **SELECT** 3. Exhaustive RAM, or type 3, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Exhaustive RAM test. If the test fails again, continue to the next corrective action step.

(a) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram an d Paragraph 4.4 for procedure on removing board).

(b) The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.5 8253 Timer

1. Test Summary. The 8253 Timer test verifies the ability of the 8253 timer chip to read outputs, inputs and counting ability. The CPU Board directs the Analog Controller Board to set the timer to a specific time interval. After that time period, the CPU verifies proper timer operation.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set the EXTENDED mode.

(c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.

(e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.

(f) Cursor and **SELECT** 4. 8253 Timer, or type **4**, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the 8253 Timer test. If the test fails again, continue to the next corrective action step.

(a) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

(b) The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.6 Host Interrupt

1. Test Summary. The Host Interrupt test verifies the ability of the Analog Controller Board to successfully interrupt a CPU Board function.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set the EXTENDED mode.

(c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.

(e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.

(f) Cursor and **SELECT** 5. Host Interrupt, or type 5, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Host Interrupt test. If the test fails again, continue to the next corrective action step.

(a) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram an d Paragraph 4.4 for procedure on removing board).

(b) The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.7 Bus Communication

1. Test Summary. The Bus Communication test verifies the communication between the Analog Controller Board and the Multi-Bus RAM.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.
   (e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 6. Bus Communication, or type 6, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Bus Communication test. If the test fails again, continue to the next corrective action step.
   (a) Perform all other Analog Controller Board tests, Paragraph 3.3.2.
   (b) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram an d Paragraph 4.4 for procedure on removing board).
   (c) A communications problem is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.8 RAM Checksum

1. Test Summary. The RAM Checksum test verifies the correct downloading of code from the hard disk by performing a summation of the contents of the memory locations in the Analog Controller Board RAM chip after a code down load and compares it with the value carried in memory.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.
   (e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.
   (f) Cursor and **SELECT** 7. RAM Checksum, or type 7, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the RAM Checksum test. If the test fails again, continue to the next corrective action step.
   (a) Perform Exhaustive RAM test, Paragraph 3.3.2.4.
   (b) Place the Analog Controller Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram an d Paragraph 4.4 for procedure on removing board).
   (c) The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.2.9 ECR Verification

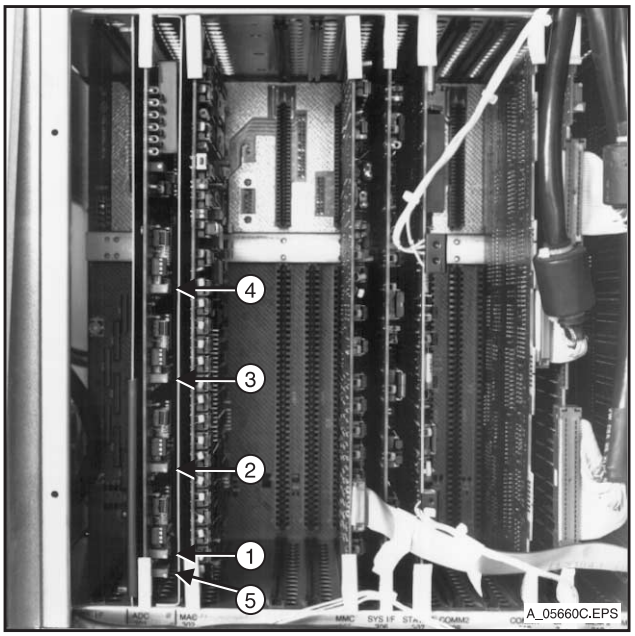
1. Test Summary. The Electronic Calibration Ratio (ECR) test displays the ADC conversion constant (slope) used to scale the conversion of ADC counts per Absorbance unit. The number displayed represents the number of ADC counts per ABS unit.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set the EXTENDED mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System or type 3, **ENTER**.

(e) Cursor and **SELECT** 1. Analog Controller Board or type 1, **ENTER**.

(f) Cursor and **SELECT** 8. ECR Verification, or type 8, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ECR Verification test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. ECR value is out of specification.	1. Perform MUX Operation test, Paragraph 3.3.4.4. 2. Perform ADC Operation test, Paragraph 3.3.3.2. 3. Perform Differential Amplifier test, Paragraph 3.3.3.3. 4. Perform Reference Signal test, Paragraph 3.3.4.5. 5. The Analog Controller Board is suspected; call the Clinical Support Center or your local Beckman representative.
2. ECR Linearity is out of specification.	1. Adjust LOG/ADC ECR Linearity. (a) Set Replicates to CONTINUOUS (F2 from the diagnostics MAIN MENU Screen). (b) Locate the five trimmer pots on the LOG/ADC Board. (c) Repeat the ECR Verification test. (d) While viewing the ECR Linearity data on the screen, turn the trimmer pot associated with the MUX failing the linearity specification so that it now falls into the specification. 2. If adjustment is unsuccessful, call the Clinical Support Center or your local Beckman representative.



1 - MUX #1 Trimmer Pot
2 - MUX #2 Trimmer Pot
3 - MUX #3 Trimmer Pot
4 - MUX #4 Trimmer Pot
5 - MUX #5 Trimmer Pot

Figure 3-4. Log ADC Board

3.3.3 CX4 LOG/ADC BOARD

The LOG/ADC (Analog-to-Digital Converter) Board receives commands from the Master Analog Controller (MAC) Board. Its primary function is to receive all analog signals originating from the photometer and to convert them to a digital value.

3.3.3.1 All LOG/ADC Board Tests

1. Test Summary. This option performs all LOG/ADC Board tests.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.

(e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.

(f) Cursor and **SELECT** 7. All LOG/ADC Board tests, or type 7, **ENTER**.

4. Corrective Action. If any of the LOG/ADC Board tests fail, refer to the section below for that specific test.

3.3.3.2 ADC Operation

1. Test Summary. The Analog-to-Digital Converter (ADC) Operation test verifies both ADC and ADC multiplexer operation.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 1. ADC Operation, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ADC Operation test. If the test fails again, continue to the next corrective action step.
   (a) Perform all Analog Board tests, Paragraph 3.3.2.
   (b) Perform all CPU Board tests, Paragraph 3.1.2.
   (c) Place the LOG/ADC Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (d) The LOG/ADC Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.3.3 Differential Amplifiers

1. Test Summary. The Differential Amplifiers test performs tests on the Preamp circuit by reading the differential amplifier offset and the ratio of the Preamp Calibration Reference voltage to the LOG/ADC reference voltage. In addition the Differential Amplifiers test monitors the Reference Calibration network responsible for ECR Calibration signal generation.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 2. Differential Amplifiers, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Differential Amplifiers test. If the test fails again, continue to the next corrective action step.
   (a) Perform all LOG/ADC Board tests, Paragraph 3.3.3.
   (b) Perform all CPU Board tests, Paragraph 3.1.2.
   (c) Place the LOG/ADC Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).
   (d) The LOG/ADC Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.3.4 Sample and Hold

1. Test Summary. The Sample and Hold test verifies the Preamp Calibration source, Preamp Integrator circuits, the Auto-Zero, and the Sample and Hold circuits. These readings verify the ratio of the maximum calibration signal to the LOG/ADC reference voltage, the three point calibration ratios and input signals to the log conversion circuits.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.

(e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.

(f) Cursor and **SELECT** 3. Sample and Hold, or type 3, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sample and Hold test. If the test fails again, continue to the next corrective action step.

(a) Perform the Differential Amplifiers test, Paragraph 3.3.3.3.

(b) Place the LOG/ADC Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

(c) The LOG/ADC or the Preamp Board are suspected; call the Clinical Support Center or your local Beckman representative.

3.3.3.5 LOG Circuit

1. Test Summary. The LOG Circuit test verifies operation of the complete system of electronic circuits, verifying signal operation from the Preamp Calibration circuits through the data conversion circuits. The LOG Circuit test verifies linearity adjustments of the five log conversion signal channels.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.

(e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.

(f) Cursor and **SELECT** 4. LOG Circuit, or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the LOG Circuit test. If the test fails again, continue to the next corrective action step.

(a) Place the LOG/ADC Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

(b) The LOG/ADC Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.3.6 Sample and Hold Drift

1. Test Summary. The Sample and Hold Drift test measures the drift rate of the Sample and Hold chips by monitoring the Log Conversion circuit outputs with a low-level signal stored (held) in the Sample and Hold circuits.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.

(e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.

(f) Cursor and **SELECT** 5. Sample and Hold Drift, or type 5, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sample and Hold Drift test. If the test fails again, continue to the next corrective action step.

(a) Perform the Sample and Hold test, Paragraph 3.3.3.4.

(b) Place the LOG/ADC Board on a flat surface and gently press down on all chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

(c) The LOG/ADC Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.3.7 Noise Level

1. Test Summary. The Noise Level test evaluates the composite noise level of the ten Preamp detector circuits combined with the five log conversion channels. Noise evaluation is made using low level signals switched through various detector circuits. The mean and standard deviation of the readings is calculated. The standard deviation is displayed on the operators screen in ADC units. The lamp and monochromator are dark for this test. The CPU Board will determine the relative noise level from the standard deviation.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 2. LOG/ADC Board, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 6. Noise Level, or type 6, **ENTER**.
4. Corrective Action. There are no additional diagnostic tests that will isolate system noise if the noise test is out of specification. Call the Clinical Support Center or your local Beckman representative.

3.3.4 CX4 PREAMP BOARD

3.3.4.1 All Preamp Board Tests

1. Test Summary. This option performs all Preamp Board tests.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Preamp Board, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 6. All Preamp Boards Tests, or type 6, **ENTER**.
4. Corrective Action. If any of the Preamp Board tests fail, refer to the section below for that specific test.

3.3.4.2 Charge Compensation

1. Test Summary. The Charge Compensation test measures the Preamp Integrator circuits signal with the lamp and calibration signals turned off.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Preamp Board, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 1. Charge Compensation, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Charge Compensation test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Charge Compensation signals are significantly out of specification.	1. Perform Preamp Board MUX Operation test, Paragraph 3.3.4.4. 2. The Preamp Boards are suspected, call the Clinical Support Center or your local Beckman representative.

SYMPTOM	CORRECTIVE ACTION
2. Charge Compensation signals are slightly out of specification.	1. The Preamp Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.4.3 Drift

1. Test Summary. The Preamp Board Drift test checks for Preamp integrator drift.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Preamp Board, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 2. Drift, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Drift test. If the test fails again, continue to the next corrective action step.
   (a) Perform MUX Operation test, Paragraph 3.3.4.4.
   (b) The Preamp Board may be suspected; call the Clinical Support Center or your local Beckman representative.

3.3.4.4 MUX Operation

1. Test Summary. The Multiplexer (MUX) Operation test monitors a preamp voltage through the five preamp multiplexers, and also verifies the differential amplifier offset voltages on the LOG Converter Board. Data is displayed in raw ADC counts.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Preamp Board, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 3. MUX Operation, or type 3, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MUX Operation test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. All MUX reference readings are out of specification.	1. Verify 5-volt power supply is within specification from Status Monitor. 2. The Preamp Board is suspected; call the Clinical Support Center or your local Beckman representative.
2. Less than all five MUX reference readings are out of specification.	1. Perform Preamp Reference Signal Procedure, Paragraph 3.3.4.5. 2. The Preamp Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.4.5 Reference Signal

1. Test Summary. The Reference Signal test verifies the Reference Regulated Supply voltage, and verifies the Preamp multiplexer operation. The Regulated Supply serves as the Calibration signal source for the instrument Electronic Calibration Ratio (ECR) calibration measurements.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Preamp Board, or type 3, **ENTER**.

(f) Cursor and **SELECT** 4. Reference Signal, or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Reference Signal test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. All reference signals are out of specification.	1. Perform Preamp MUX Operation test, Paragraph 3.3.4.4. 2. The Preamp Board is suspected; call the Clinical Support Center or your local Beckman representative.
2. Less than all MUX reference signals are out of specification.	1. Perform Preamp MUX Operation test, Paragraph 3.3.4.4. 2. Perform Log/ADC Differential Amplifiers test, Paragraph 3.3.3.3. 3. The Preamp Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.3.4.6 Blocked Light Path

1. Test Summary. The Blocked Light Path test checks the amount of stray light entering into the preamps from the monochromator. The reaction wheel is rotated to the HOME position, and blocks the light path to the monochromator. With the wheel at the HOME position, the light beam is aimed between two cuvettes, blocking the beam from the monochromator entrance slit. Transmittance light measurements (counts) are displayed to indicate the amount of stray light entering the optical system.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Preamp Board, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 5. Blocked Light Path, or type 5. **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Blocked Light Path test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. All MUX readings are out of specification.	1. Verify the reaction carousel is at the HOME position. 2. Perform Differential Amplifiers test, Paragraph 3.3.3.3. 3. Perform the Preamp MUX Operation test, Paragraph 3.3.4.4. 4. The Preamp Board is suspected; call the Clinical Support Center or your local Beckman representative.
2. Less than all MUX readings are out of specification.	1. Perform all Preamp Board tests, Paragraph 3.3.4.

3.3.5 CX4 XENON LAMP/MONOCHROMATOR

3.3.5.1 Lamp DAC Operation

1. Test Summary. The Lamp DAC Operation test verifies the ability to adjust the power supply output voltage to compensate for flash degradation due to lamp aging.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 4. Xenon Lamp/ Monochromator, or type 4, **ENTER**.
   (f) Cursor and **SELECT** 1. Lamp DAC Operation, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Lamp DAC Operation test. If the test fails again, continue to the next corrective action step.

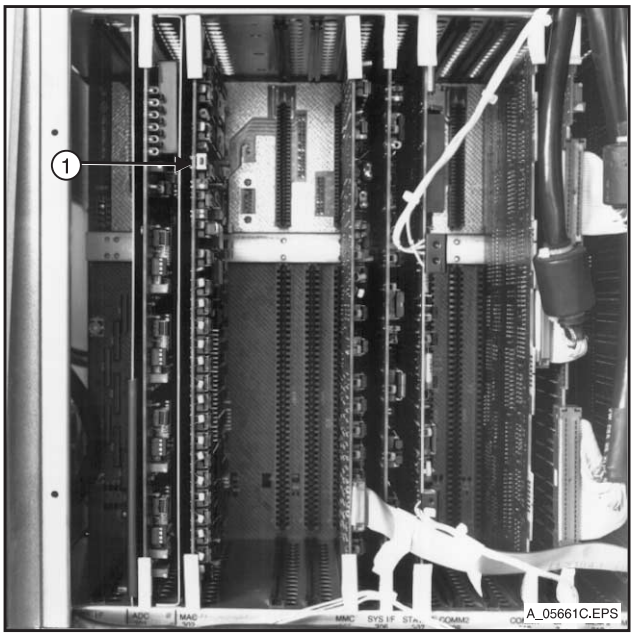
(a) Perform Wash All Cuvettes, Paragraph 3.9.7.

(b) Inspect Reaction Carousel for broken cuvettes.

(c) Call the Clinical Support Center or your local Beckman representative.

3.3.5.2 Automatic Lamp Flash

1. Test Summary. The Automatic Lamp Flash test verifies correct operation of the lamp. Lamp operation is verified by seeing the lamp flash or by hearing a high-pitched sound when the lamp flashes.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 4. Xenon Lamp/ Monochromator, or type 4, **ENTER**.
   (f) Cursor and **SELECT** 2. Automatic Lamp Flash, or type 2. **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Automatic Lamp Flash test. If the test fails again, continue to the next corrective action step.
   (a) Press manual lamp trigger button and observe.
   (b) Call the Clinical Support Center or your local Beckman representative.



1 - Manual Lamp Trigger Button

Figure 3-5. Master Analog Controller Board

3.3.5.3 Lamp Energy

1. Test summary. The Lamp Energy test evaluates the output energy of the lamp by flashing the lamp and recording the transmittance. The test fails if the recorded energy does not fall within specifications.
2. Materials required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 4. Xenon Lamp/ Monochromator, or type 4, **ENTER**.
   (f) Cursor and **SELECT** 3. Lamp Energy, or type 3, **ENTER**.
4. Corrective action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Lamp Energy test. If the test fails again, continue to the next corrective action step.

(a) Perform Wash All Cuvettes, Paragraph 3.9.7.

(b) Perform all EXTENDED Mode Analog Control System tests, Paragraph 3.3.2.

(c) Inspect the reaction carousel for broken cuvettes.

(d) The lamp power supply or the lamp is suspected; call the Clinical Support Center or your local Beckman representative.

ALIGNMENT MODE PROCEDURES

3.3.6 CX4 FLASH DELAY ADJUSTMENT

1. Procedure Summary. The Flash Delay Adjustment procedure determines the lamp flash timing for each cuvette. This procedure is conducted in air, and takes several absorbance readings, all taken at different time intervals since the cuvette passed the SYNC Sensor. The system determines the optimum absorbance for each cuvette and records the time delay associated with it. This value is used to schedule the flash timing of each cuvette as the cuvette passes the lamp. This procedure should be performed when a new reaction carousel has been installed or the reaction carousel sensors have been realigned.

NOTE

This procedure requires approximately 20 minutes to complete.

Ensure diluted wash bottles are full.

If cuvettes have not been cleaned within the last six months, clean cuvettes before beginning procedure. (Refer to CX4/CX5/CX7 DELTA, CX4CE/CX5CE/CX7 Operating Instructions.

2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 1. Flash Delay Adjustment, or type 1, **ENTER**.
   (f) Select a number between 1 —80 (multiple numbers allowed), **ENTER**.
4. Special Instructions.
   (a) Look for consistency between cuvette data. If an individual cuvette has a flash delay time that is greatly different from the other cuvettes, check the cuvette for cracks and repeat the Flash Delay Adjustment procedure for that cuvette only.
   (b) If values are erratic, perform Wash All Cuvettes, Paragraph 3.9.7.
   (c) Call the Clinical Support Center or your local Beckman representative.

3.3.7 CX4 FLASH POWER SUPPLY ADJUSTMENT

1. Procedure Summary. The Flash Power Supply Adjustment procedure sets the optimum lamp energy output for all 80 cuvettes at all wavelengths. This procedure is required when the reaction carousel or lamp has been replaced.

NOTE

If cuvettes have not been cleaned within the last six months, clean cuvettes before beginning procedure. (Refer to CX4/CX5/CX7 DELTA, CX4CE/CX5CE/CX7 Operating Instructions.

2. Materials Required. None.

NOTE

Before beginning this procedure, ensure diluted wash bottles are full.

3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 2. Flash Power Supply Adjustment, or type 2, **ENTER**.

NOTE

This procedure requires approximately 30 minutes to complete. A premature exit of the Flash Power procedure will incorrectly set the lamp power to zero which could adversely affect other diagnostic procedures. Exiting diagnostics will return lamp power to the previous setting; re-executing the procedure will generate a new lamp power setting. After completion, Lamp Calibration (Paragraph 3.3.8) MUST be completed.

4. Special Instructions.
   (a) Request a printout of the flash power data at the completion of the procedure using the **PRINT SCREEN** key.

3.3.8 CX4 LAMP CALIBRATION

1. Procedure Summary. The Lamp Calibration procedure sets the flash calibration matrix for all 80 cuvettes at all wavelengths by defining the flash-to-flash spectral noise and energy noise levels. This procedure must be performed after lamp replacement or alignment.

NOTE

This procedure requires approximately 70 minutes to complete.

Ensure diluted wash bottles are full.

2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 3. Analog Control System, or type 3, **ENTER**.
   (e) Cursor and **SELECT** 3. Lamp Calibration, or type 3, **ENTER**.
4. Special Instructions.
   (a) Request a printout of the Lamp Calibration data.

3.4 CX4 TEMPERATURE CONTROL SYSTEM

3.4.1 DESCRIPTION

The Temperature Control functional area monitors the temperature of all thermal system components, the sensor status and the sensor voltage output to the heater boards.

NOTE

PRIMARY Mode tests should be run prior to any test in the EXTENDED Mode. If all PRIMARY Mode tests pass, refer to Paragraph 3.4.1.3 for additional EXTENDED Mode tests to be run. All PRIMARY Mode failures should be confirmed through EXTENDED Mode testing.

3.4.1.1 Error Conditions

The following error conditions are associated with this diagnostic module:

Reaction Carousel temperature out of specification

Cuvette wash water temperature out of specification

Cuvette rinse water temperature out of specification

Reagent refrigerator temperature out of specification

Poor correlation of enzyme chemistries against reference system

3.4.1.2 Modules

The following modules are tested under the Temperature Control functional area:

Reaction Carousel Heater

Cuvette Wash Water Heater

Cuvette Rinse Water Heater

Reagent Refrigerator (Peltier)

3.4.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Reaction Carousel Heater	3.4.2	
Temperature Test	3.4.2.1	Primary, Extended
Board Calibration Constants	3.4.2.2	Extended
Sensor Calibration Constants	3.4.2.3	Extended
Fine Temperature Adjustments	3.4.2.4	Extended
Heater System Control Test	3.4.2.5	Primary, Extended
Cuvette Wash Water Heater	3.4.3	
Temperature Test	3.4.3.1	Primary, Extended
Board Calibration Constants	3.4.3.2	Extended
Sensor Calibration Constants	3.4.3.3	Extended
Fine Temperature Adjustments	3.4.3.4	Extended
Heater System Control Test	3.4.3.5	Primary, Extended
Cuvette Rinse Water Heater	3.4.4	
Temperature Test	3.4.4.1	Primary, Extended
Board Calibration Constants	3.4.4.2	Extended
Sensor Calibration Constants	3.4.4.3	Extended
Fine Temperature Adjustments	3.4.4.4	Extended
Heater System Control Test	3.4.4.5	Primary, Extended
Reagent Refrigerator Peltier	3.4.5	
Temperature Test	3.4.5.1	Primary, Extended

3.4.2 REACTION CAROUSEL HEATER TESTS

3.4.2.1 Temperature Test

1. Test Summary. The Reaction Carousel Temperature Test reports the following:

   (a) Reported Temperature: the actual temperature of the operating system.

   (b) Temperature sensor: indicates whether the temperature control system is operating within its limits.

   (c) Sensor Output Voltage: the voltage signal from the temperature sensor used to determine the approximate temperature. The operator determines whether the output voltage is within the acceptable range given on the screen. In addition, the operator has the ability to turn the heater on and off to verify heater operation.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.

   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.

   (f) Cursor and **SELECT** 1. Temperature Test, or type 1, **ENTER**.

4. Corrective Action. The following table lists the possible temperature test results and their resolution. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Reaction Carousel Temperature Test. If the test fails again, continue to the next corrective action step.

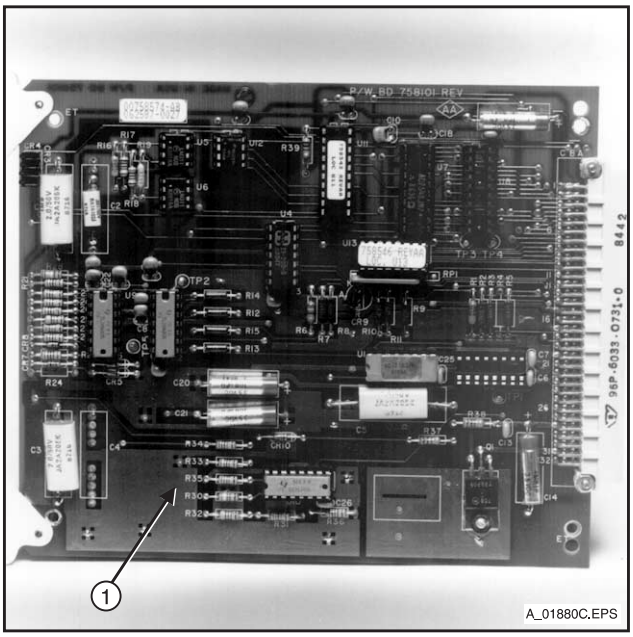
TEST RESULTS			CORRECTIVE ACTION
Reported Temp.	Temp. Sensor	Sensor Output Voltage	Steps
OUT OF RANGE	OK	OK	1. Confirm temperature with an external device. 2. Perform Reaction Carousel Heater System Control test, Paragraph 3.4.2.5. 3. Confirm heater board calibration constants agree with those coded into memory (refer to Paragraph 3.4.2.2). 4. Place the Reaction Carousel Heater Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board). 5. The Reaction Carousel Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.
OUT OF RANGE	FAIL	OK	1. The Reaction Carousel is suspected; call the Clinical Support Center or your local Beckman representative.
OUT OF RANGE	OK	OUT OF RANGE	1. The Reaction Carousel is suspected; call the Clinical Support Center or your local Beckman representative.

NOTE

When replacing the Reaction Carousel Heater Board, the calibration constants associated with the replacement board must be coded into the operating software through Board Calibration Constants (refer to Paragraph 3.4.2.2).

3.4.2.2 Board Calibration Constants

1. Test Summary. This procedure displays the calibration values stored in the EPROM on the temperature controllers and allows them to be modified. The FACTORY CALIBRATION DATA is printed directly on the reaction carousel heater board and must be coded into the instrument software whenever the board is replaced.
2. Materials Required. The FACTORY CALIBRATION DATA must be obtained from the face of the replacement board in order to complete this procedure.



1 - Board Calibration Constant Location

Figure 3-6. Heater Controller Board

3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.
   (f) Cursor and **SELECT** 2. Board Calibration Constants, or type 2, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Type the 8-digit Factory Calibration Constant and press **ENTER**.
   (i) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not applicable.

3.4.2.3 Sensor Calibration Constants

1. Test Summary. This procedure displays the sensor calibration value within the EPROM and allows it to be modified. This number is printed directly on the reaction carousel and must be coded into the instrument software whenever the reaction carousel is replaced.
2. Materials Required. The new sensor calibration constant value must be obtained from the face of the replacement reaction carousel in order to complete this procedure.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen. **ENTER**.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.
   (f) Cursor and **SELECT** 3. Sensor Calibration Constants, or type 3, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not applicable.

3.4.2.4 Fine Temperature Adjustment

The Fine Temperature Adjustment procedure requires measurement of the reaction wheel temperature. This procedure must be performed by trained Beckman personnel.

3.4.2.5 Heater System Control

1. Test Summary. This test verifies the operation of the digital-to-analog converters (DAC) that specify the set point temperature of the reaction carousel.
2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.

   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.

   (f) Cursor and **SELECT** 5. Heater System Control Test, or type 5, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Heater System Control test. If the test fails again, continue to the next corrective action step.

   (a) Place the Reaction Carousel Heater Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board).

   (b) The Reaction Carousel Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.

NOTE

When replacing the reaction carousel heater board, the calibration constants associated with the replacement board must be coded into the operating software through Board Calibration Constants (refer to Paragraph 3.4.2.2).

3.4.3 CX4 CUVETTE WASH WATER HEATER TESTS

3.4.3.1 Temperature Test

1. Test Summary. The Cuvette Wash Water Heater test reports the following:

   (a) Reported Temperature: the actual temperature of the operating system. This value should be within 5.0 degrees of the set point temperature (either 30°C or 37°C).

   (b) Temperature sensor: indicates whether the temperature control system is operating within limits. The status will be either "OK" or "FAIL".

   (c) Sensor Output Voltage: The voltage signal from the temperature sensor used to determine the approximate temperature. The operator determines whether the output voltage is within the acceptable range given on the screen. In addition, the operator has the ability to turn the heater on and off to verify heater operation.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) **F2 SETUP OPTIONS** to select operation mode.

   (b) **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.

   (e) Cursor and **SELECT** 2. Cuvette Wash Water Heater, or type 2, **ENTER**.

   (f) Cursor and **SELECT** 1. Temperature Test, or type 1, **ENTER**.

4. Corrective Action. The following table lists the possible temperature test results and the resolutions. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Cuvette Wash Water Temperature test. If the test fails again, continue to the next corrective action step.

TEST RESULTS			CORRECTIVE ACTION
Reported Temp.	Temp. Sensor	Sensor Output Voltage	Steps
OUT OF RANGE	OK	OK	1. Confirm temperature with an external device. 2. Perform Cuvette Wash Water Heater System Control test, Paragraph 3.4.3.5. 3. Confirm heater board calibration constants agree with those coded into memory (refer to Paragraph 3.4.3.2). 4. Place the Cuvette Wash Water Heater Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board). 5. The Cuvette Wash Water Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.
OUT OF RANGE	FAIL	OK	1. The Cuvette Wash Water Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.
OUT OF RANGE	OK	OUT OF RANGE	1. The Cuvette Wash Water Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.

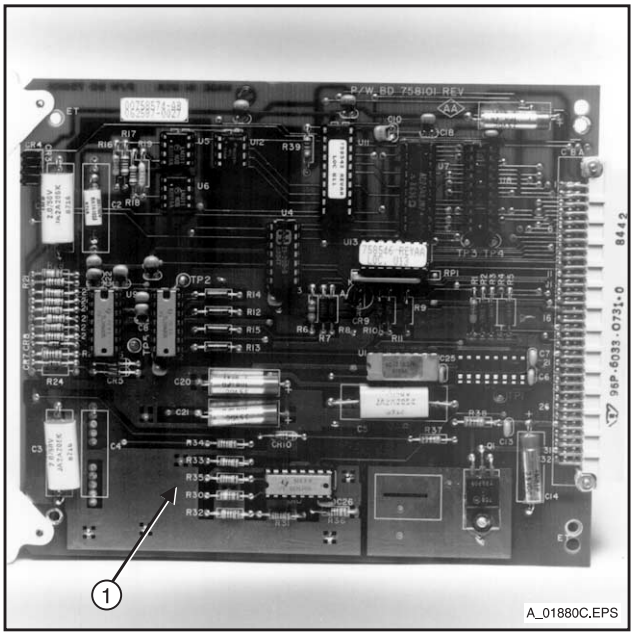
NOTE

When replacing the Cuvette Wash Water Heater Board, the calibration constants associated with the replacement board must be coded into the operating software through Board Calibration Constants (refer to Paragraph 3.4.3.2).

3.4.3.2 Board Calibration Constants

1. Test Summary. This procedure displays the calibration constants stored in the EPROM on the temperature controllers and allows it to be modified. The FACTORY CALIBRATION DATA, the number used to determine the calibration constant, is printed directly on the cuvette wash water heater board and must be coded into the instrument software whenever it is replaced.

2. Materials Required. The new board FACTORY CALIBRATION DATA must be obtained from the face of the replacement board in order to complete this procedure.



1 - Board Calibration Constant Location

Figure 3-7. Heater Controller Board

3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 2. Cuvette Wash Water Heater, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 2. Board Calibration Constants, or type 2, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Type the 8-digit Factory Calibration Constant and press **ENTER**.
   (i) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not applicable.

3.4.3.3 Sensor Calibration Constants

1. Test Summary. This procedure displays the calibration number associated with the cuvette wash water heater sensor currently installed on the system and allows it to be modified. Modification may be required if a replacement sensor has different FACTORY CALIBRATION DATA than that held in system memory. The sensor FACTORY CALIBRATION DATA is located directly on the sensor. If no FACTORY CALIBRATION DATA is given on the sensor, then no modification is required.
2. Materials Required. The FACTORY CALIBRATION DATA must be obtained from the face of the replacement sensor in order to complete this procedure. If no FACTORY CALIBRATION DATA is given on the replacement sensor, then no modification is required.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 2. Cuvette Wash Water Heater, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 3. Sensor Calibration Constants, or type 3, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not applicable.

3.4.3.4 Fine Temperature Adjustment

1. Test Summary. This procedure provides the ability to adjust the temperature of the cuvette wash water heater a maximum of 5.0 degrees. Performing this procedure will change the temperature of the cuvette wash water heater without changing the reported temperature on the STATUS monitor.
2. Materials Required. None.

NOTE

After performing this procedure, you MUST perform Paragraph 3.4.3.1 to restore power to the cuvette wash water heater.

3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 2. Cuvette Wash Water Heater, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 4. Fine Temperature Adjustments, or type 4, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Press **F2 UPDATE EPROM**.
   (i) Corrective Action. Not applicable.

3.4.3.5 Heater System Control

1. Test Summary. This test verifies the operation of the digital-to-analog converters (DAC) that specify the set point temperature of the cuvette wash water heater.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 2. Cuvette Wash Water Heater, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 5. Heater System Control Test, or type 5, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Heater System Control test. If the test fails again, continue to the next corrective action step.

(a) Place the Cuvette Heater Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure for removing board).

(b) The Cuvette Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.

NOTE

When replacing the cuvette wash water heater board, the calibration constant associated with the replacement board must be coded into the operating software through Board Calibration Constants (Paragraph 3.4.3.2).

3.4.4 CX4 CUVETTE RINSE WATER HEATER TESTS

3.4.4.1 Temperature Test

1. Test Summary. The Temperature Test comprises three components:

   (a) Reported Temperature: the actual temperature of the operating system. This value should be within 5.0 degrees of the set point temperature (either 30°C or 37°C).

   (b) Temperature sensor: indicates whether the temperature control system is operating within its limits. This status will be either “OK” or “FAIL”.

   (c) Sensor Output Voltage: the voltage signal from the temperature sensor used to determine the approximate temperature. The operator determines whether the output is within the acceptable range given on the screen. In addition, the operator has the ability to turn the heater on and off to verify heater operation.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   a) Press **F2 SETUP OPTIONS** to select operation mode.

   (d) Press **SELECT** to set EXTENDED mode.

   (e) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (f) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.

   (g) Cursor and **SELECT** 3. Cuvette Rinse Water Heater, or type 3, **ENTER**.

   (h) Cursor and **SELECT** 1. Temperature Test, or type 1, **ENTER**.

4. Corrective Action. The following table lists the possible temperature test results and the resolutions. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Cuvette Rinse Water Temperature test. If the test fails again, continue to the next corrective action step.

TEST RESULTS			CORRECTIVE ACTION
Reported Temp.	Temp. Sensor	Sensor Output Voltage	Steps
OUT OF RANGE	OK	OK	1. Perform Cuvette Rinse Water Heater System Control test, Paragraph 3.4.4.5. 2. Confirm heater board calibration constants agree with those coded into memory (refer to Paragraph 3.4.4.2). 3. Place the Cuvette Rinse Water Heater Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure on removing board). 4. The Cuvette Rinse Water Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.
OUT OF RANGE	FAIL	OK	1. The Cuvette Rinse Water Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.
OUT OF RANGE	OK	OUT OF RANGE	1. The Cuvette Rinse Water Heater Board is suspected; call the Clinical Support Center or your local Beckman representative.

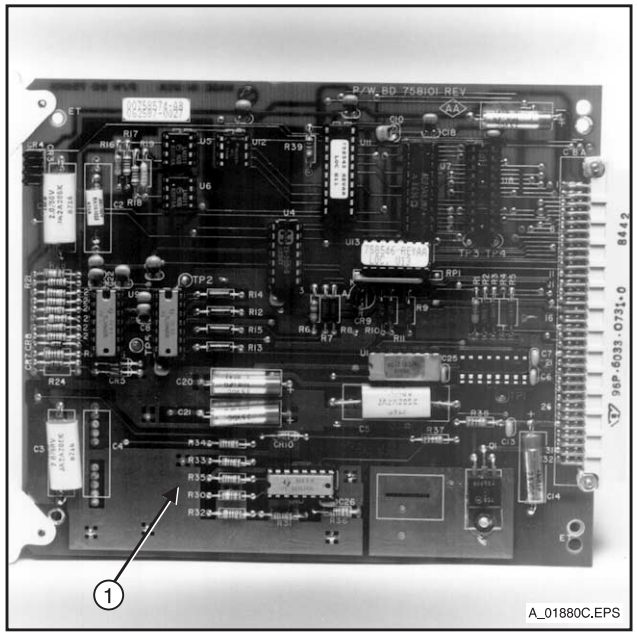
NOTE

When replacing the Cuvette Rinse Water Heater Board, the calibration constants associated with the replacement board must be coded into the operating software through Board Calibration Constants (refer to Paragraph 3.4.4.2).

3.4.4.2 Heater Board Calibration Constants

1. Test Summary. This procedure displays the calibration constants stored in the EPROM on the temperature controllers and allows it to be modified. The FACTORY CALIBRATION DATA, the number used to determine the calibration constant, is printed directly on the cuvette rinse water heater board and must be coded into the instrument software whenever it is replaced.

2. Materials Required. The FACTORY CALIBRATION DATA must be obtained from the face of the replacement board in order to complete this procedure.



1 - Board Calibration Constant Location

Figure 3-8. Heater Controller Board

3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 3. Cuvette Rinse Water Heater, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 2. Board Calibration Constants, or type 2, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Type the 8-digit Factory Calibration Constant and press **ENTER**.
   (i) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not applicable.

3.4.4.3 Sensor Calibration Constants

1. Test Summary. This procedure displays the sensor calibration values within the EPROM and allows them to be modified. The FACTORY CALIBRATION DATA, the number used to determine the calibration constant, is located directly on the sensor and must be coded into the instrument software whenever it is replaced.
2. Materials Required. The FACTORY CALIBRATION DATA must be obtained from the face of the replacement sensor in order to complete this procedure.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 3. Cuvette Rinse Water Heater, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 3. Sensor Calibration Constants, or type 3, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not Applicable.

3.4.4.4 Fine Temperature Adjustment

1. Test Summary. This procedure provides the ability to adjust the temperature of the cuvette rinse water heater a maximum of 5.0 degrees. Performing this procedure will change the operating temperature of the cuvette rinse water heater without changing the reported temperature on the STATUS Monitor.
2. Materials Required. None.

NOTE

After performing this procedure, you MUST perform Paragraph 3.4.4.1 to restore power to the Cuvette Rinse Water heater.

3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 3. Cuvette Rinse Water Heater, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 4. Fine Temperature Adjustments, or type 4, **ENTER**.
   (g) Press **F1 MODIFY VALUES**.
   (h) Press **F2 UPDATE EPROM**.
4. Corrective Action. Not applicable.

3.4.4.5 Heater System Control

1. Test Summary. This test verifies the operation of the digital-to-analog converters (DAC) that specify the set point temperature of the cuvette rinse water heater.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 3. Cuvette Rinse Water Heater, or type 3, **ENTER**.
   (f) Cursor and **SELECT** 5. Heater System Control Test, or type 5, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Heater System Control test. If the test fails again, continue to the next corrective action step.
   (a) Place the Cuvette Rinse Water Heater Board on a flat surface and gently press down on all the chips (refer to Appendix C for board location diagram and Paragraph 4.4 for procedure for removing board).

(b) The Cuvette Rinse Water Heater Board is suspected, call the Clinical Support Center or your local Beckman representative.

NOTE

When replacing the cuvette rinse water heater board, the calibration constant associated with the replacement board must be coded into the operating software through Board Calibration Constants (Paragraph 3.4.4.2).

3.4.5 CX4 REAGENT REFRIGERATOR PELTIER

3.4.5.1 Peltier Temperature Test

1. Test Summary. The Reagent Refrigerator Peltier Temperature Test reports the following:
   (a) Reported Temperature: the actual temperature of the operating system. This value should be between 1.6°C and 3.4°C.
   (b) Temperature sensor: indicates whether the temperature control system is operating within limits. The status will be either "OK" or "FAIL".
   (c) Sensor Output Voltage: The voltage signal from the temperature sensor used to determine the approximate temperature. The operator determines whether the output voltage is within the acceptable range given on the screen.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 4. Temperature Control System, or type 4, **ENTER**.
   (e) Cursor and **SELECT** 4. Reagent Refrigerator Peltier, or type 4, **ENTER**.
   (f) Cursor and **SELECT** 1. Temperature Test, or type 1, **ENTER**.
4. Corrective Action.
   (a) Perform visual check for reagent refrigerator fan operation (refer to Section 9 in Operating Instructions).
   (b) Check for ice or condensation in the refrigerator (refer to Section 9 in Operating Instructions).
   (c) Clean Peltier filter (refer to Section 9 in Operating Instructions).
   (d) Call the Clinical Support Center or your local Beckman representative.

3.5 CX4 SAMPLE SYSTEM

3.5.1 DESCRIPTION

The Sample System functional area verifies the operation of the following sample handling components: Sample Probe motors, sensors, and alignment; Sample Mixer motors, sensors, and alignment; Liquid Level Sensor, Sector Reader, Sample Bar Code Reader, Sample Carousel motor and home sensor, Sample Autoloader motor and alignment, and Sample Syringe alignment.

NOTE

PRIMARY Mode tests should be run prior to any test in the EXTENDED Mode. If all PRIMARY Mode tests pass, refer to Paragraph 3.5.1.3 for additional extended tests to be run. All PRIMARY Mode failures should be confirmed through EXTENDED Mode testing.

3.5.1.1 Error Conditions

The following Motion Errors are associated with the sample system:

Misalignment of probes
Autoloader malfunction
Misread sector numbers
Sensor failure
Sample sector not being processed

3.5.1.2 Modules

The following modules are tested under the SAMPLE HANDLING SYSTEM functional area:

PRIMARY MODE

Probe Rotary/Elevation
Mixer Rotary/Elevation
Syringe Valve
Liquid Level Sense

EXTENDED MODE

Probe
Mixer

Sample Carousel
Autoloader
Sample Bar Code Reader

ALIGNMENT MODE

Probe Rotary Alignment
Mixer Rotary Alignment
Probe Vertical Alignment
Mixer Vertical Alignment
Syringe Pump Flag Alignment
Sample Probe Height Adjustment and Centering Alignment
Sample Carousel/CX3 and ISE Probe Alignment
Probe Height Adjustment
Mixer Height Adjustment
Sample Bar Code Reader Alignment
Autoloader Timing Adjustment

3.5.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Probe	3.5.2	
Sensor Check	3.5.2.1	Primary, Extended
Rotary Motor	3.5.2.2	Primary, Extended
Up/Down Motor	3.5.2.3	Primary, Extended
Liquid Level Sense	3.5.2.4	Extended
Mixer	3.5.3	
Sensor Check	3.5.3.1	Primary, Extended
Rotary Motor	3.5.3.2	Primary, Extended
Up/Down Motor	3.5.3.3	Primary, Extended
Spin Motor	3.5.3.4	Extended
Sample Carousel	3.5.4	
Sensor Check	3.5.4.1	Primary, Extended
Rotary Motor	3.5.4.2	Primary, Extended
Read Sector	3.5.4.3	Extended
Autoloader	3.5.5	
Sensor Check	3.5.5.1	Primary, Extended
Rotary Motor	3.5.5.2	Primary, Extended
Push Button	3.5.5.3	Extended
Sample Bar Code Reader	3.5.6	Extended
Probe Rotary Alignment	3.5.7	Alignment
Mixer Rotary Alignment	3.5.8	Alignment
Probe Vertical Alignment	3.5.9	Alignment
Mixer Vertical Alignment	3.5.10	Alignment
Syringe Pump Flag Alignment	3.5.11	Alignment
Sample Probe Height Adjustment and Centering Alignment	3.5.12	Alignment
Sample Carousel/CX3 and ISE Probe Alignment	3.5.13	Alignment
Probe Height Adjustment	3.5.14	Alignment
Mixer Height Adjustment	3.5.15	Alignment
Sample Bar Code Reader Alignment	3.5.16	Alignment
Autoloader Timing Adjustment	3.5.17	Alignment

3.5.2 CX4 Probe

3.5.2.1 Sensor Check

1. Test Summary. The Probe Sensor Check test provides the operator with the ability to raise, lower, and rotate the sample probe to confirm rotary detent, rotary home and elevator home, and sense or operation. The operator is requested to move the sample probe arm and verify that the sensor status changes, indicating that sensor is operational.

NOTE

If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing the PREV SCREEN key, then the HOME key.

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sensor Check test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Rotary Detent or Rotary Home sensors are not operational.	1. Ensure full range of motion was covered while performing this test. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Rotary Detent or Rotary Home sensors are operational. Probe Rotary Alignment is suspected.	1. Perform Rotary Motor test, Paragraph 3.5.2.2. 2. Call the Clinical Support Center or your local Beckman representative.
3. Elevator Home sensor is not operational.	1. Ensure full range of motion was covered while performing this test. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected, call the Clinical Support Center or your local Beckman representative.
4. Elevator Home sensor is operational. Probe Vertical Alignment is suspected.	1. Perform Up/Down test, Paragraph 3.5.2.3. 2. Call the Clinical Support Center or your local Beckman representative.

3.5.2.2 Rotary Motor

1. Test Summary. The Probe Rotary Motor test verifies the operation of the sample probe rotary motor and rotary alignment of the sample probe arm. The operator is requested to press **ENTER** to rotate the probe. The test fails if the probe does not rotate or if the probe rotates but the sensors do not change.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F1 ROTARY MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Rotary Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Probe Arm does not rotate.	1. Verify cable is intact and connected. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Probe Arm rotates but sensors do not operate.	1. Perform Probe Rotary Alignment, Paragraph 3.5.7. 2. Call the Clinical Support Center or your local Beckman representative.

3.5.2.3 Up/Down Motor

1. Test Summary. The Probe Up/Down Motor test verifies the operation of the elevator motor and the vertical alignment of the sample probe arm. The operator is requested to press **ENTER** to raise and lower the sample probe and verify the sensor status.

NOTE

If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing **PREV SCREEN**, then **HOME**.

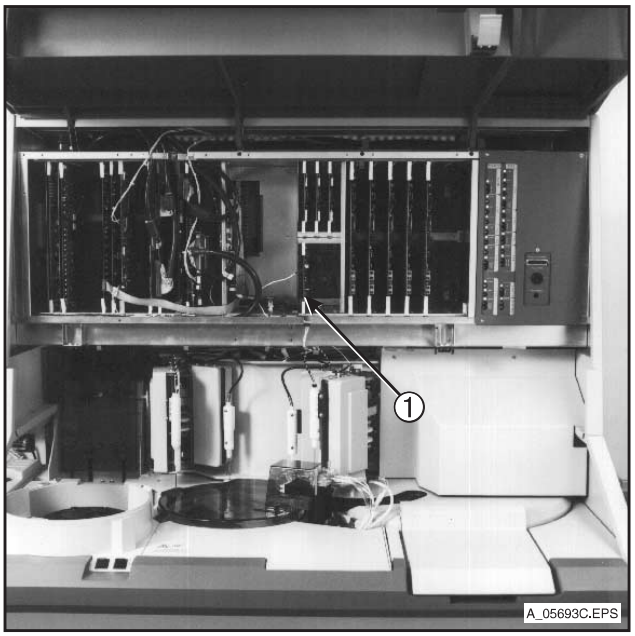
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F2 UP/DOWN MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Up/Down Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Probe Arm does not raise or lower.	1. Verify cable is intact and connected. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The Up/Down Motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Probe Arm moves but sensors do not operate.	1. Perform Probe Vertical Alignment, Paragraph 3.5.9. 2. Call the Clinical Support Center or your local Beckman representative.

3.5.2.4 Level Sense

1. Test Summary. The Probe Level Sense test verifies that the liquid level sensor is functioning properly via a simulated liquid signal.
2. Materials Required. A saline-soaked cotton-tipped applicator is required to complete this test.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F3 LEVEL SENSE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Level Sense test. If the test fails again, continue to the next corrective action step.
   (a) Verify cable on probe arm is intact and connected to level sense board.
   (b) The level sense board or sample probe assembly is suspected; call the Clinical Support Center or your local Beckman representative.



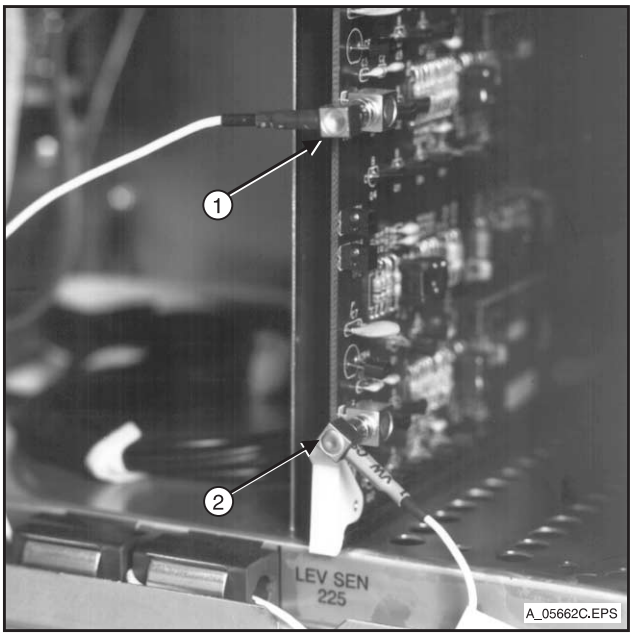
1 - Level Sense Board Location

Figure 3-9. CX4 Boards

3.5.3 CX4 MIXER

3.5.3.1 Sensor Check

1. Test Summary. The Mixer Sensor check provides the operator the ability to raise, lower, and rotate the mixer arm to confirm rotary detent, rotary home, and elevator home sensor operation. The operator is requested to move the mixer arm and verify that sensor status changes.



1 - Sample Probe Level Sense Connector
2 - Reagent Probe Level Sense Connector

Figure 3-10. Level Sense Board

NOTE

If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing PREV SCREEN, then HOME.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sensor Check test. If the test fails again, continue to the next corrective action step

SYMPTOM	CORRECTIVE ACTION
1. Rotary Detent, Rotary Home sensors are not operational.	1. Ensure full range of motion is covered while performing this test. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Rotary Detent or Rotary Home sensors are operational. Mixer Alignment is suspected.	1. Perform Rotary Motor test, Paragraph 3.5.3.2.
3. Elevator Home sensor is not operational.	1. Ensure full range of motion is covered while performing this test. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
4. Elevator Home sensor is operational. Mixer Vertical Alignment is suspected.	1. Perform Up/Down Motor test, Paragraph 3.5.3.3.

3.5.3.2 Rotary Motor

1. Test Summary. The Mixer Rotary Motor test verifies the operation of the mixer arm rotary motor and the alignment of the mixer arm. The operator is requested to press **ENTER** to rotate the mixer to the wash station, over to the cuvette, and to the home position. While the mixer is located over the wash station and cuvette, the operator may evaluate mixer alignment.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.

   (f) Press **F1 CONTINUE**.

   (g) Press **F1 ROTARY MOTOR**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Rotary Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Mixer Arm does not rotate.	1. Verify cable on mixer arm is intact and connected. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The Rotary Motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Mixer Arm rotates but sensors do not operate.	1. Perform Mixer Rotary Alignment, Paragraph 3.5.8.

3.5.3.3 Up/Down Motor

1. Test Summary. The Mixer Up/Down Motor test verifies the operation of the elevator motor and sensor operation. The operator is requested to press **ENTER** to raise and lower the mixer and check elevator home sensor operation.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F2 UP/DOWN MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Up/Down Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Mixer Arm does not raise or lower.	1. Verify that cable on mixer arm is intact and connected. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Mixer Arm moves but sensors do not operate.	1. Perform Mixer Vertical Alignment, Paragraph 3.5.10.

3.5.3.4 Spin Motor

1. Test Summary. The Mixer Spin Motor test verifies the operation of the Sample Mixer Spin Motor. The operator is requested to press the **ENTER** key to momentarily spin the mixer motor and verify operation by either hearing the mixer spin or seeing the mixer turn on or off.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F3 SPIN MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Spin Motor test. If the test fails again, continue to the next corrective action step.
   (a) Verify that cable on mixer arm is intact and connected.

(b) Perform MSC Board diagnostics, Paragraph 3.2.3.

(c) The spin motor is suspected, call the Clinical Support Center or your local Beckman representative.

3.5.4 SAMPLE CAROUSEL

3.5.4.1 Sensor Check

1. Test Summary. The Sample Carousel Sensor test provides the operator the ability to manually rotate the sample carousel to verify sensor operation. The operator is requested to move the sample carousel and verify that the sensor status changes, indicating sensor operation.

NOTE

If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing **PREV SCREEN**, then **HOME**.

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 3. Sample Carousel, or type 3, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sensor Check test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Rotary Detent or Rotary Home sensors are not operational.	1. Ensure sample carousel is slowly rotated through full range. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Rotary Detent or Rotary Home sensors are operational; Rotary Motor or Rotary Alignment is suspected.	1. Perform Rotary Motor test, Paragraph 3.5.4.2 2. Call the Clinical Support Center or your local Beckman representative.

3.5.4.2 Rotary Motor

1. Test Summary. The Sample Carousel Rotary Motor test verifies the sample carousel alignment and the operation of the sample carousel rotary motor. The operator is requested to place a sector on the carousel and press **ENTER**. The system will then rotate that sector to various cup positions relative to the sample probe.

NOTE

Sample carousel cover must be removed prior to beginning this test.

2. Materials Required. Sample sector
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 3. Sample Carousel, or type 3, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F1 ROTARY MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Rotary Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Sample Carousel does not move.	1. Perform MSC Board diagnostics, Paragraph 3.2.3. 2. The Rotary Motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Sample Carousel moves, Sample Alignment is suspected.	1. Perform Sample Carousel Alignment, Paragraph 3.5.13.

3.5.4.3 Read Sector (non CX DELTA Systems only)

1. Test Summary. The Sector Reader test verifies the operation of the sector bar code reader and allows the operator to check for correct sector bar code label placement. The operator is requested to place a sector(s) on the sample carousel; the system will pass each sector in front of the sector reader and register the sector number on the operators screen. If no sector is present, the screen will register a 0.
2. Materials Required. One or more sample sectors.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 3. Sample Carousel, or type 3, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F2 READ SECTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Read Sector test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Sector incorrectly read.	1. Repeat test with known good sector label. 2. Sector Reader or board are suspect; call the Clinical Support Center or your local Beckman representative.
2. Known good sector label reads correctly but other sector labels do not.	1. Verify that the label is correctly aligned on the sector. 2. Remove and place new labels on all suspect sectors. 3. Call the Clinical Support Center or your local Beckman representative.

3.5.5 AUTOLOADER SYSTEM

3.5.5.1 Sensor Check

1. Test Summary. The Autoloader Sensor test verifies that the LOAD and STAT LOAD buttons operate when pressed. The operator is requested to press each button and verify that the sensor status changes from OFF to ON.

NOTE

If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing **PREV SCREEN**, then **HOME**.

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 4. Autoloader, or type 4, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sensor Check test. If the test fails again, continue to the next corrective action step.
   (a) Perform Push Button test, Paragraph 3.5.5.3.

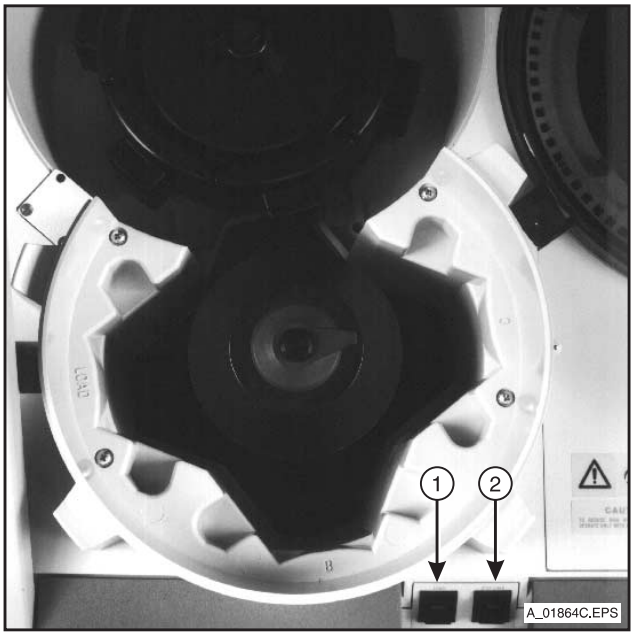
(b) The sensors are suspected; call the Clinical Support Center or your local Beckman representative.

3.5.5.2 Rotary Motor

1. Test Summary. The Autoloader Rotary Motor test verifies the operation of the Autoloader rotary motor and the Autoloader alignment. The operator is requested to press **ENTER** to raise, rotate, and lower the autoloader, verifying rotary motor operation and autoloader alignment.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 4. Autoloader, or type 4, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F1 ROTARY MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Rotary Motor test. If the test fails again, continue to the next corrective action step.
   (a) Check that air pressure is sufficient.
   (b) Press **HOME** to home the Autoloader.
   (c) Loosen the screw on top of the autoloader, pull up on the autoloader, and manually adjust it to proper alignment. Tighten the screw.
   (d) The Rotary Motor is suspected; call the Clinical Support Center or your local Beckman representative.

3.5.5.3 Push Button

1. Test Summary. The Autoloader Button test verifies the correct operation of the LOAD and STAT LOAD buttons, and that the lightbulbs inside are still active. The operator is requested to press ENTER to turn the LOAD or STAT LOAD button ON and OFF.



1 - LOAD Button
2 - STAT LOAD Button

Figure 3-11. Autoloader Assembly

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 4. Autoloader, or type 4, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F2 PUSH BUTTON**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Push Button test. If the test fails again, continue to the next corrective action step.
   (a) Pop off button cover and check for burned-out lightbulbs.

(b) The buttons are suspected; call the Clinical Support Center or your local Beckman representative.

3.5.6 SAMPLE BAR CODE READER

WARNING

DO NOT TAMPER WITH OR REMOVE HOUSING OF SAMPLE BARCODE READER. THE SAMPLE BARCODE READER IS A CLASS II MOVING BEAM LASER SCANNER.

1. Test Summary. This procedure tests that the sample bar code reader is reading sample IDs correctly.
2. Materials Required.

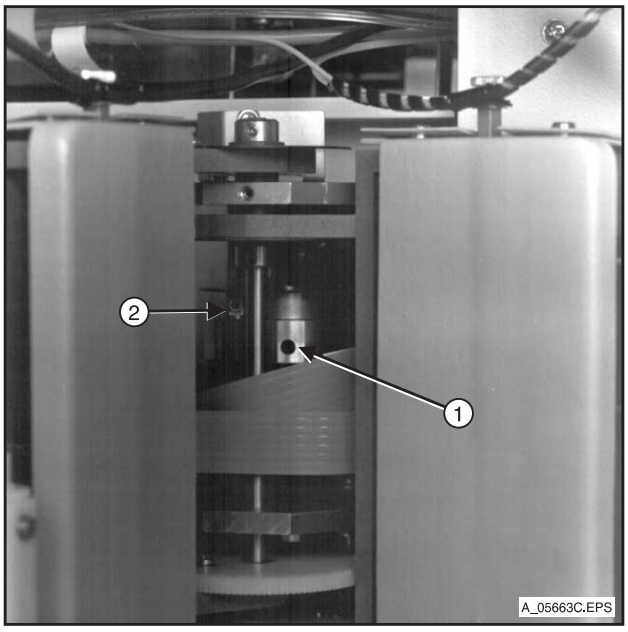
   Sector(s).

   Sample tubes with bar codes.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type **5**, **ENTER**.
   (e) Cursor and **SELECT** 5. Sample Bar Code Reader, or type **5**, **ENTER**.
4. Corrective Action. If the test fails, perform Sample Bar Code Reader Alignment, Paragraph 3.5.16.

ALIGNMENT MODE PROCEDURES

3.5.7 CX4 PROBE ROTARY ALIGNMENT

1. Procedure Summary. This procedure aids the operator in aligning the sample probe.
2. Materials Required. Allen Wrench
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type **5**, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe Rotary Alignment, or type **1**, **ENTER**.
4. Special Instructions.
   (a) Rotate probe arm to access rotary detent flag set screw.
   (b) Rotate fine adjustment screw clockwise to its stop.
   (c) Loosen rotary detent flag set screws.
   (d) Rotate probe arm and center over reaction carousel cuvette #43.
   (e) Center probe in cuvette #43 using left/right arrow keys for counterclockwise/clockwise probe rotation and up/down arrow keys for vertical up/vertical off.
   (f) Rotate detent flag so that sensor is ON and white timing mark is aligned with pivot shaft.
   (g) Tighten one rotary detent set screw.
   (h) Rotate fine adjustment screw counterclockwise until sensor just toggles from ON to OFF.

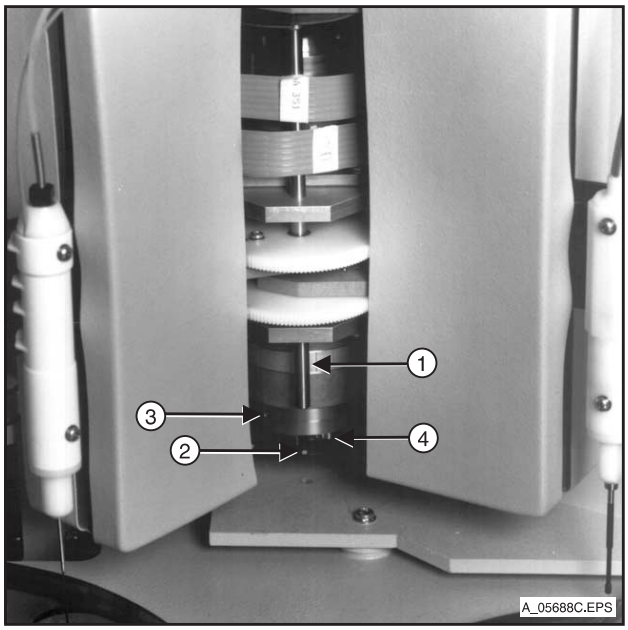


1 - Rotary Detent Set Screw
2 - Fine Adjustment Screw

Figure 3-12. CX4 Sample Probe Rotary Alignment

   (i) Tighten second set screw.
   (j) Verify the probe is centered over reaction carousel cuvette.

(k) Verify sensor status toggles during slight rotary movement of probe arm.



1 - Pivot Shaft
2 - White Timing Mark
3 - Rotary Detent Set Screw
4 - Fine Adjustment Screw

Figure 3-13. CX4 Sample Probe Rotary Shaft and Screws

3.5.8 CX4 MIXER ROTARY ALIGNMENT

1. Procedure Summary. This procedure aids the operator in aligning the sample mixer.

2. Materials Required.

   Allen Wrench.

   User-defined cartridge with water in compartment A, loaded as H_2O.

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 2. Mixer Rotary Alignment, or type 2, **ENTER**.

4. Special Instructions.

   (a) Rotate mixer arm to access rotary detent flag set screw.

   (b) Rotate fine adjustment screw clockwise to its stop.

   (c) Loosen rotary detent flag set screws.

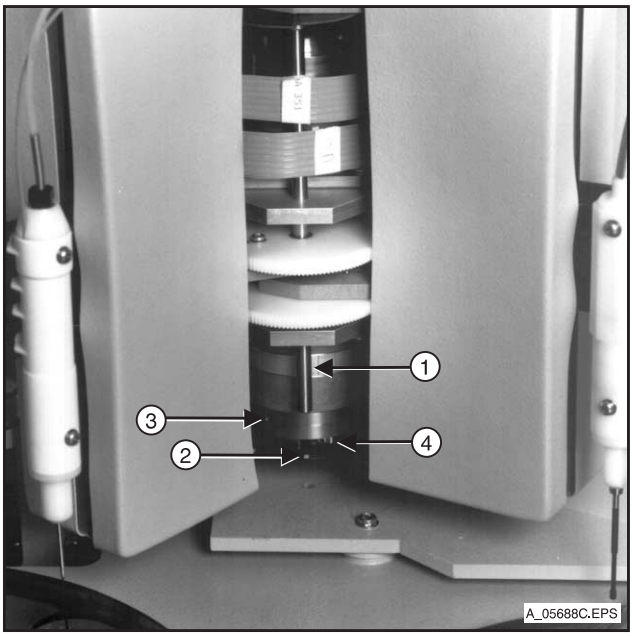
   (d) Rotate mixer arm and center over reaction carousel cuvette #43.

   (e) Center probe in cuvette #43 using left/right arrow keys for counterclockwise/clockwise probe rotation and up/down arrow keys for vertical up/vertical off.

   (f) Rotate detent flag so that sensor is ON and white timing mark is aligned with pivot shaft.

   (g) Tighten one rotary detent flag set screw.

   (h) Rotate fine adjustment screw until sensor just toggles from ON to OFF (or vice versa). Observe the SENSOR STATUS window on the system console.



1 - Pivot Shaft
2 - White Timing Mark
3 - Rotary Detent Set Screw
4 - Fine Adjustment Screw

Figure 3-14. CX4 Sample Mixer Rotary Alignment

(i) Tighten second set screw.

(j) Verify the mixer is centered over reaction carousel cuvette.

(k) Verify sensor status toggles during slight rotary movement of mixer arm. Observe the SENSOR STATUS window on the system console.

3.5.9 CX4 PROBE VERTICAL ALIGNMENT

1. Procedure Summary. This procedure automatically adjusts the vertical alignment of the sample probe.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 3. Probe Vertical Alignment, or type 3, **ENTER**.
4. Special Instructions. None.

3.5.10 CX4 MIXER VERTICAL ALIGNMENT

1. Procedure Summary. This procedure automatically adjusts the vertical alignment of the sample mixer.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 4. Mixer Vertical Alignment, or type 4, **ENTER**.
4. Special Instructions. None.

3.5.11 CX4 SYRINGE PUMP FLAG ALIGNMENT

1. Procedure Summary. This procedure automatically adjusts the alignment of the sample pump.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.
   (e) Cursor and **SELECT** 5. Syringe Pump Flag Alignment, or type 5, **ENTER**.
4. Special Instructions. None.

3.5.12 SAMPLE PROBE HEIGHT ADJUSTMENT AND CENTERING ALIGNMENT (CX3 and ISE)

1. Procedure Summary. This test allows proper adjustment and verification of height and alignment of the sample probe to the EIC, and chemistry cup modules (CX7). Perform this procedure after Sample Crane Removal and Replacement (Paragraph 4.20) and Sample Probe Replacement (Paragraph 4.21).

2. Material Required.

   Sample Probe Height Tool - P/N 464599*

   Sample Probe Centering Tool (CX7) - P/N 467695*

   Sample Probe Centering Tool (CX5) - P/N 440734*

   Allen Wrenches - 5/64", 7/64"

   * Required tools included in the CX Ship Kit.

   Detailed steps:

   CX3 Probe Height Adjustment Procedure (CX7 systems only, proceed to Sample Probe Centering Alignment for CX5)

3. Procedure Access. From the Diagnostics MAIN MENU screen:

   (a) Press **CX3 DIAG**.

   (b) Press **F2 MECH TESTS**.

   (c) Press **F2 SAMPLE PROBE**.

   (d) Install the Sample Probe Height Adjustment tool (P/N 464599) onto the TP/CA cup module.

   (e) Press **F2 SELECT POSITION**, follow screen prompt, then select **1** TP Cup, or **1** CA Cup, to move sample probe to the TP/CA cup module

   (f) Loosen the probe height collar located at the junction of the probe arm and body using the allen wrenches located in the instrument maintenance kit.

   (g) Follow screen prompt. Loosen the locking screw on the probe arm and adjust the probe arm so that the probe tip is flush with the top of the Sample Probe Height tool. Hold the probe arm to maintain its position and move the probe height collar up against the bottom of the arm. Fasten the locking screws securely. Remove alignment tool. Proceed to Sample Probe Centering Alignment step d) for CX7 systems.

Sample Probe Centering Alignment (CX7 and CX5)

   (a) Press **ISE DIAG (or CX3 DIAG)**.

   (b) Press **F2 MECH TESTS**.

   (c) Press **F2 SAMPLE PROBE**.

   (d) Install the Sample Probe Centering tool - CX7 P/N 467695 (white), CX5 P/N 440734 (black), securely onto the EIC. (To ensure proper seating of the Centering tool, it may be necessary to remove rear cup module cover).

   (e) Press **F5 HOME PROBE**. Follow screen prompts.

   (f) Adjust the probe arm according to applicable alignment procedure:

   CX7: Loosen the rotational locking screw and align the probe arm so that probe tip is centered just above, but not in, the hole of the centering tool. (Do not loosen probe height collar screws). Fasten locking screw securely.

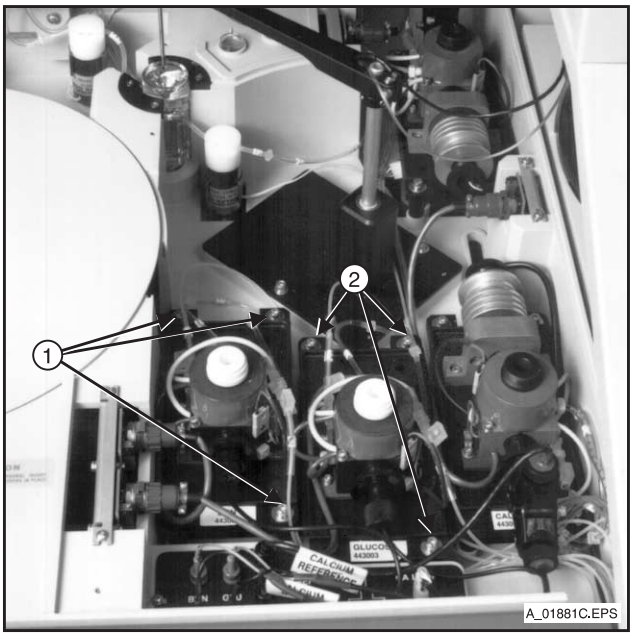
   CX5: Loosen the rotational locking screw, and probe height collar screws on probe arm. Align the probe arm so that the probe tip is centered just above, but not in, the hole of the centering tool. Hold the probe arm to maintain its position and move the probe height collar up against the bottom of the arm. Fasten locking screws securely.

   Ensure that the probe is centered both transversely and rotationally.

   (g) Press **F5 HOME PROBE**. Remove centering tool. Proceed to CX3 Aligning the Cup Modules to the Sample Probe (for CX7 systems). Proceed to the Sample Carousel/CX3 and ISE Probe Alignment Paragraph 3.5.13 (for CX5 systems).

CX3 Aligning the Cup Modules to the Sample Probe (CX7 Systems only)

Use the Diagnostics function **F2 SELECT POSITION** to move the sample probe rotationally to each of the other chemistry module positions and align each module; BUN, GLU, CRE, TP(CA) to the sample probe. Loosen modules by unscrewing the three module retaining screws, and adjust to the probe.



1 - BUN3 Retaining Screws
2 - GLU3 Retaining Screws

Figure 3-15. Chemistry Cup Modules

Perform the Sample Carousel/CX3 and ISE Probe Alignment Procedure Paragraph 3.5.13 after completing cup module alignment.

3.5.13 SAMPLE CAROUSEL/CX3 AND ISE PROBE ALIGNMENT

1. Procedure Summary. This procedure aids the operator in aligning the sample carousel.

2. Materials Required.

   Slotted Screwdriver
   One Sector
   Centering Tool - P/N 756956
   Depth Tool - P/N 756989

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 6. Sample Carousel/CX3 or ISE Probe Alignment, or type 6, **ENTER**.

4. Special Instructions.

   (a) Verify CX3/ISE probe alignment, and CX4 sample probe to reaction carousel alignment. (Refer to Paragraphs 3.11.2, 3.14.2, 3.5.7, and 3.5.12).

   (b) Place the centering tool P/N 756956 in position 6 of a sector. Place the sector onto sample carousel position 6.

   (c) Loosen the three sample carousel base mounting screws.

   (d) Manually rotate the sample carousel until the sample probe is centered over the centering tool in position 6.

   (e) Tighten the three sample carousel base mounting screws.

   (f) Center probe over centering tool. Left/right arrows rotate sample carousel and up/down arrows rotate sample probe.

   (g) Verify probe is centered over centering tool.

   (h) Keep the sector in position 6 to complete autoloader to sample carousel alignment.

   (i) Center autoloader arms in load tray recesses (up/down arrows) and align mark on the sector (located on top front edge of lower section at middle of position 4) with mark on the autoloader hub (left/right arrows).

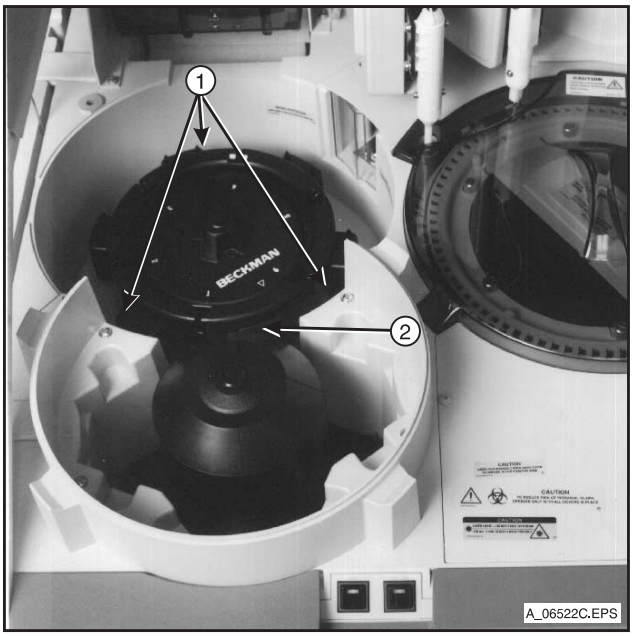
   (j) Center CX3/ISE probe over centering tool. Left/right arrows rotate sample carousel and up/down arrows rotate CX3/ISE probe.

   (k) Replace the centering tool with the depth tool P/N 756989.

   (l) Move the probe up or down using the up/down arrow keys until the probe moves the plunger flush with the top of the depth tool.

   (m) Verify the CX3/ISE sample probe is centered over the depth tool.

   (n) Remove the sample sector.



1 - Base Mounting Screws
2 - Autoloader Arm Centered Between Sample Carousel Arms

Figure 3-16. Autoloader to Sample Carousel Alignment

3.5.14 CX4 PROBE HEIGHT ADJUSTMENT

1. Procedure Summary. This procedure automatically adjusts the sample probe height. The operator is requested to lower the probe as far as it will go, after which the probe will readjust its height by counting the steps required to elevate back to home position.

2. Materials Required.

   Three Sectors.

   Three 0.5-mL Sample Cups.

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 7. Probe Height Adjustment, or type **7**, **ENTER**.

4. Special Instructions.

   (a) Clear area around sample probe and mixer.

   (b) Lower probe as far as possible into oval alignment hole (not cuvette).

3.5.15 CX4 MIXER HEIGHT ADJUSTMENT

1. Procedure Summary. This procedure automatically adjusts the sample mixer height. The operator is requested to lower the mixer as far as it will go, after which the mixer will readjust its height by counting the steps required to elevate back to home position.

2. Materials Required. None.

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type **5**, **ENTER**.

   (e) Cursor and **SELECT** 8. Mixer Height Adjustment, or type **8**, **ENTER**.

NOTE

Prior to beginning this procedure, remove the reaction carousel cover.

4. Special Instructions.

   (a) Clear area around sample probe and mixer.

   (b) Lower mixer as far as possible into oval alignment hole (not cuvette).

3.5.16 SAMPLE BAR CODE READER ALIGNMENT

WARNING

DO NOT TAMPER WITH OR REMOVE HOUSING OF SAMPLE BARCODE READER. THE SAMPLE BARCODE READER IS A CLASS II MOVING BEAM LASER SCANNER.

1. Procedure Summary. This procedure aids the operator in aligning the sample bar code reader.

2. Materials Required.

   Sector
   Sample tube with bar code label

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 9. Sample Bar Code Reader Alignment, or type 9, **ENTER**.

4. Special Instructions.

   (a) Verify if there is a separate sector reader (non CX DELTA systems) in the sample well and press <**Y**> or <**N**> at the prompt. (Visually examine sample well to verify if sector reader is present or not).

   (b) Press **F8** ONLY if setting up new bar code equipment, or if it is necessary to reinitialize the bar code decoder board. (This downloads default configuration data to Bar Code Reader).

   (c) If necessary, align CX4 sample carousel. Refer to Paragraph 3.5.13.

   (d) Place a sample tube with bar code label in position 1 of a sector. Place the sector onto sample carousel in position 1.

   (e) Move (or step) sample carousel using left/right arrows until leading edge of the sector slot is just entering the laser beam.

   (f) Remove sample sector.

   (g) Press **ENTER** to execute alignment changes.

   (h) Press **F8** to exit. (Alignment settings will **not be saved** and misalignment may occur if any other method is used to exit screen).

3.5.17 AUTOLOADER TIMING ADJUSTMENT

1. Procedure Summary. This procedure allows the operator to adjust the autoloader timing.

2. Materials Required. None.

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 5. Sample System, or type 5, **ENTER**.

   (e) Cursor and **SELECT** 10. Autoloader Timing Adjustment, or type 10, **ENTER**.

4. Special Instructions.

   (a) Clear area around sample wheel and autoloader.

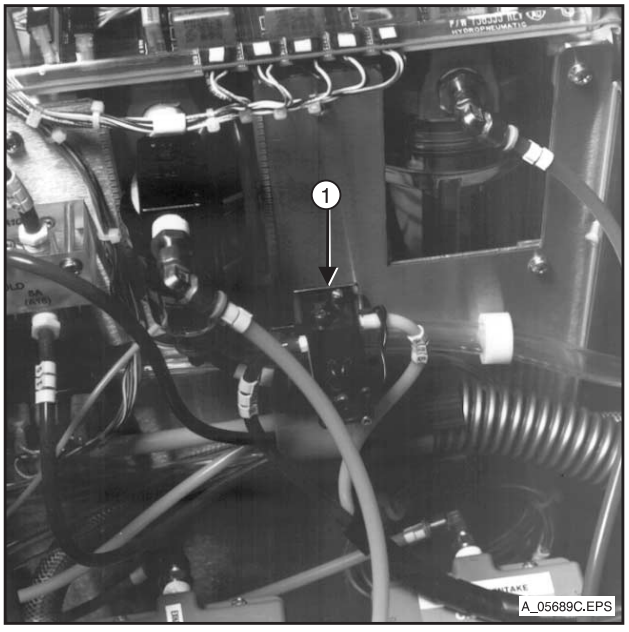
   (b) Pull the hydropneumatic assembly drawer open to allow access to the autoloader MAC valve.

   (c) Confirm adjustment screws are closed by turning clockwise, and then open each screw 1 turn counterclockwise.

   (d) Press **F2** to cycle 5 times. Turn the B adjustment screw clockwise to increase the autoloader up time. Turn counterclockwise to decrease the up time.

   (e) Press **F2** to cycle 5 times. Turn the A adjustment screw clockwise to increase the autoloader down time. Turn counterclockwise to decrease the down time.

   (f) Press **F2** to cycle 5 times. Check up/down time.



1 - Autoloader Timing Valve

Figure 3-17. Hydropneumatic Assembly

3.6 CX4 REAGENT SYSTEM

3.6.1 DESCRIPTION

The Reagent System functional area verifies correct operation and alignment of the reagent probes, motors, and sensors. This system includes the reagent probe, reagent mixer, and reagent carousel.

NOTE

PRIMARY Mode tests should be run prior to any test in the EXTENDED Mode. If all PRIMARY Mode tests pass, refer to Paragraph 3.6.1.3 for additional EXTENDED Mode tests to be run. All PRIMARY Mode failures should be confirmed through EXTENDED Mode testing.

3.6.1.1 Error Conditions

Motion errors associated with Reagent System
Misalignment of probes
Sensor failure
System imprecision
Calibration failure

3.6.1.2 Modules

The following modules are tested under the REAGENT HANDLING SYSTEM functional area:

PRIMARY MODE

Probe Rotary/Elevation
Mixer Rotary/Elevation
Syringe Valve
Liquid Level Sense
Reagent Carousel Motion

EXTENDED MODE

Probe
Mixer

ALIGNMENT MODE

Probe Rotary Alignment
Mixer Rotary Alignment
Probe Vertical Alignment
Mixer Vertical Alignment
Reagent Carousel Flag Alignment
Syringe Pump Flag Alignment
Probe Height Adjustment
Mixer Height Adjustment

3.6.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Probe	3.6.2	
Sensor Check	3.6.2.1	Extended
Rotary Motor	3.6.2.2	Primary, Extended
Up/Down Motor	3.6.2.3	Primary, Extended
Liquid Level	3.6.2.4	Primary, Extended
Mixer	3.6.3	
Sensor Check	3.6.3.1	Extended
Rotary Motor	3.6.3.2	Primary, Extended
Up/Down Motor	3.6.3.3	Primary, Extended
Spin Motor	3.6.3.4	Primary, Extended
Probe Rotary Alignment	3.6.4	Alignment
Mixer Rotary Alignment	3.6.5	Alignment
Probe Vertical Alignment	3.6.6	Alignment
Mixer Vertical Alignment	3.6.7	Alignment
Reagent Carousel		
Flag Alignment	3.6.8	Alignment
Syringe Pump Flag Alignment	3.6.9	Alignment
Probe Height Adjustment	3.6.10	Alignment
Mixer Height Adjustment	3.6.11	Alignment

3.6.2 CX4 PROBE

3.6.2.1 Sensor Check

1. Test Summary. The Probe Sensor Check test provides the operator the ability to raise, lower, and rotate the reagent probe to confirm rotary detent, rotary home, elevator home, and liquid level sensor operation. The operator is requested to move the reagent probe arm and verify that the sensor status changes.

   NOTE

   If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing **PREV SCREEN**, then **HOME**.

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type **6**, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Sensor Check test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Rotary Detent or Rotary Home sensors are not operational.	1. Ensure full range of motion was covered while performing this test. 2. Perform MSC Board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Rotary Detent or Rotary Home Rotary Motor and Rotary Alignment are suspected.	1. Perform Rotary Motor test, Paragraph 3.6.2.2.
3. Elevator Home sensor is not operational.	1. Ensure full range of motion was covered while performing this test. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
4. Elevator Home sensor is operational. Probe Elevator Motor and Vertical Alignment are suspected.	1. Perform Up/Down Motor test, Paragraph 3.6.2.3.

3.6.2.2 Rotary Motor

1. Test Summary. The Probe Rotary Motor test verifies the operation of the reagent probe rotary motor and rotary alignment of the reagent probe arm. The operator is requested to press **ENTER** to rotate the probe. The test fails if the probe does not rotate or if the probe rotates but the sensors do not change.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F1 ROTARY MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Rotary Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Probe Arm does not rotate.	1. Verify cable is intact and connected. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Probe Arm rotates but sensors do not operate. Rotary Alignment is suspected.	1. Perform Probe Rotary Alignment, Paragraph 3.6.4. 2. Call the Clinical Support Center or your local Beckman representative.

3.6.2.3 Up/Down Motor

1. Test Summary. The Probe Up/Down Motor test verifies the operation of the elevator motor and the vertical alignment of the reagent probe arm. The operator is requested to press **ENTER** to raise and lower the reagent probe and verify that the elevator home sensor is operational.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F2 UP/DOWN MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Up/Down Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Probe Arm does not raise or lower.	1. Verify cable is intact and connected. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The Up/Down Motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Probe Arm moves but sensors do not operate.	1. Perform Probe Vertical Alignment, Paragraph 3.6.6, and Probe Height Adjustment, Paragraph 3.6.9. 2. The elevator home sensor is suspected; call the Clinical Support Center or your local Beckman representative.

3.6.2.4 Liquid Level Sense

1. Test Summary. The Probe Level Sense test verifies that the liquid level sensor is functioning properly via a simulated liquid signal.
2. Materials Required. A saline-soaked, cotton-tipped applicator.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe, or type 1, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F3 LEVEL SENSE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Level Sense test. If the test fails again, continue to the next corrective action step.
   (a) Verify cable on probe arm is intact and connected.
   (b) The Level Sense Board or Reagent Probe is suspected; call the Clinical Support Center or your local Beckman representative.

3.6.3 CX4 MIXER

3.6.3.1 Sensor Check

1. Test Summary. The Mixer Sensor Check provides the operator the ability to raise, lower, and rotate the mixer arm to confirm rotary detent, rotary home, and elevator home sensor operation. The operator is requested to move the mixer arm and verify that sensor status changes.

NOTE

If a motion error occurs while viewing the SENSOR DISPLAY, it must be cleared by first pressing **PREV SCREEN**, then **HOME**.

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type **6**, **ENTER**.
   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sensor Check test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Rotary Detent, Rotary Home sensors are not operational.	1. Ensure full range of motion was covered while performing this test. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected, call the Clinical Support Center or your local Beckman representative.
2. Rotary Detent or Rotary Home sensors are operational. Rotary Motor and Mixer Alignment are suspected.	1. Perform Rotary Motor test, Paragraph 3.6.3.2.
3. Elevator Home sensor is not operational.	1. Ensure full range of motion was covered while performing this test. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The sensor is suspected; call the Clinical Support Center or your local Beckman representative.
4. Elevator Home sensor is operational. Elevator Motor and Vertical Alignment are suspected.	1. Perform Up/Down Motor test, Paragraph 3.6.3.3.

3.6.3.2 Rotary Motor

1. Test Summary. The Mixer Rotary Motor test verifies the operation of the mixer arm rotary motor and the alignment of the mixer arm. The operator is requested to press **ENTER** to rotate the mixer to the wash station, over to the cuvette, and to the home position. While the mixer is located over the wash station and cuvette, the operator may evaluate mixer alignment.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type **6**, **ENTER**.
   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F1 ROTARY MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Rotary Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Mixer Arm does not rotate.	1. Verify cable on mixer arm is intact and connected. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The Rotary Motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Mixer Arm rotates but sensor status does not change. Mixer Rotary Alignment is suspected.	1. Perform Mixer Rotary Alignment, Paragraph 3.6.5.

3.6.3.3 Up/Down Motor

1. Test Summary. The Mixer Up/Down Motor test verifies the operation of the elevator motor and sensor operation. The operator is requested to press **ENTER** to raise and lower the mixer and check elevator home sensor operation.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type **6**, **ENTER**.
   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F2 UP/DOWN MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Up/Down Motor test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Mixer Arm does not raise or lower.	1. Verify that cable on mixer arm is intact and connected. 2. Perform MSC board diagnostics, Paragraph 3.2.3. 3. The motor is suspected; call the Clinical Support Center or your local Beckman representative.
2. Mixer Arm moves but sensors do not change. Mixer Vertical Alignment is suspected.	1. Perform Mixer Vertical Alignment, Paragraph 3.6.7, and Mixer Height Adjustment, Paragraph 3.6.11.

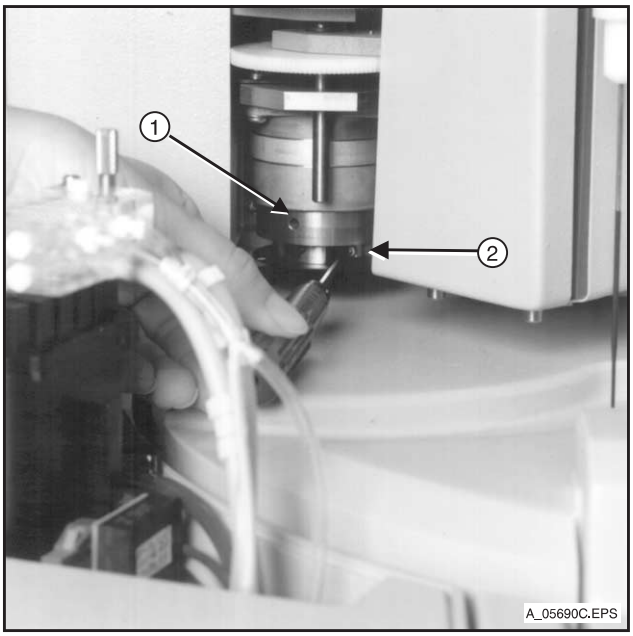
3.6.3.4 Spin Motor

1. Test Summary. The Mixer Spin Motor test verifies the operation of the Reagent Mixer Spin Motor. The operator is requested to press **ENTER** to momentarily spin the Mixer Motor and verify operation by either hearing the mixer spin or seeing the mixer turn on or off.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type **6**, **ENTER**.
   (e) Cursor and **SELECT** 2. Mixer, or type 2, **ENTER**.
   (f) Press **F1 CONTINUE**.
   (g) Press **F3 SPIN MOTOR**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Spin Motor test. If the test fails again, continue to the next corrective action step.
   (a) Verify that cable on mixer arm is intact and connected.
   (b) Perform MSC board diagnostics, Paragraph 3.2.3.
   (c) The spin motor is suspected, call the Clinical Support Center or your local Beckman representative.

ALIGNMENT MODE PROCEDURES

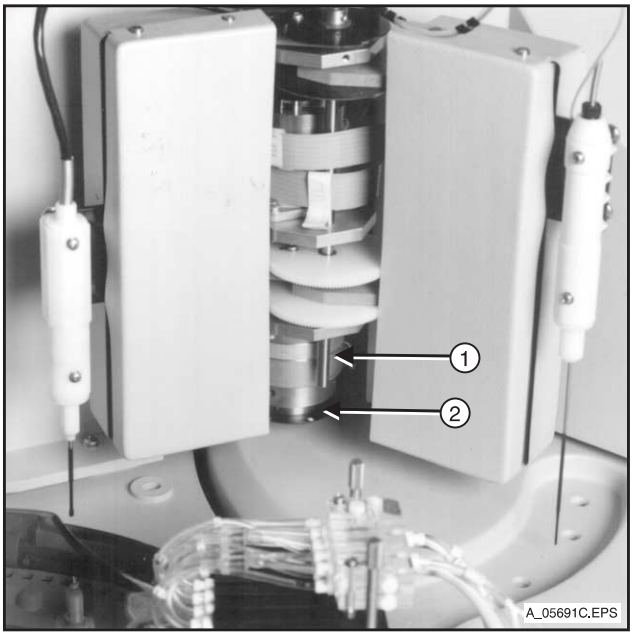
3.6.4 CX4 PROBE ROTARY ALIGNMENT

1. Procedure Summary. This procedure allows the operator to align the reagent probe between the two lateral sides of the Reaction Carousel cuvettes.
2. Materials Required. Large Allen Wrench
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type **6**, **ENTER**.
   (e) Cursor and **SELECT** 1. Probe Rotary Alignment, or type 1, **ENTER**.
4. Special Instructions.
   (a) Rotate probe arm to access rotary detent flag set screw.
   (b) Rotate fine adjustment screw clockwise to its stop.
   (c) Loosen rotary detent flag set screw.
   (d) Rotate probe arm and center over reaction carousel cuvette #63.
   (e) Center probe in cuvette #63 using left/right arrow keys for counterclockwise/clockwise probe rotation and up/down arrow keys for vertical up/vertical off.



1 - Reagent Probe Rotary Detent Set Screw
2 - Fine Adjustment Screw

Figure 3-18. CX4 Reagent Mixer Rotary Alignment



1 - Pivot Shaft
2 - White Timing Mark

Figure 3-19. CX4 Reagent Mixer Pivot Shaft

(f) Rotate detent flag so that sensor is ON and white timing mark is aligned with pivot shaft.

(g) Tighten one rotary detent flag set screw.

(h) Rotate fine adjustment screw counter-clockwise until sensor just toggles from ON to OFF. (Observe the SENSOR STATUS window on the system console.)

(i) Tighten second set screw.

(j) Verify the probe is centered over reaction carousel cuvette.

(k) Verify sensor status toggles during slight rotary movement of probe arm.

3.6.5 CX4 MIXER ROTARY ALIGNMENT

1. Procedure Summary. This procedure allows the operator to align the reagent mixer between the two lateral sides of the reaction carousel cuvettes.

2. Materials Required. Large Allen Wrench

3. Procedure Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.

   (e) Cursor and **SELECT** 2. Mixer Rotary Alignment, or type 2, **ENTER**.

4. Special Instructions.

   (a) Rotate mixer arm to access rotary detent flag set screw.

   (b) Rotate fine adjustment screw clockwise to its stop.

   (c) Loosen rotary detent flag set screws.

   (d) Rotate mixer arm and center over reaction carousel cuvette #63.

   (e) Center mixer in cuvette #63 using left/right arrow keys for counterclockwise/clockwise probe rotation and up/down arrow keys for vertical up/vertical off. (Pressing the down arrow key will remove vertical motor power to allow mixer to be brought down into the cuvette.)

   (f) Rotate detent flag so that sensor is ON and white timing mark is aligned with pivot shaft.

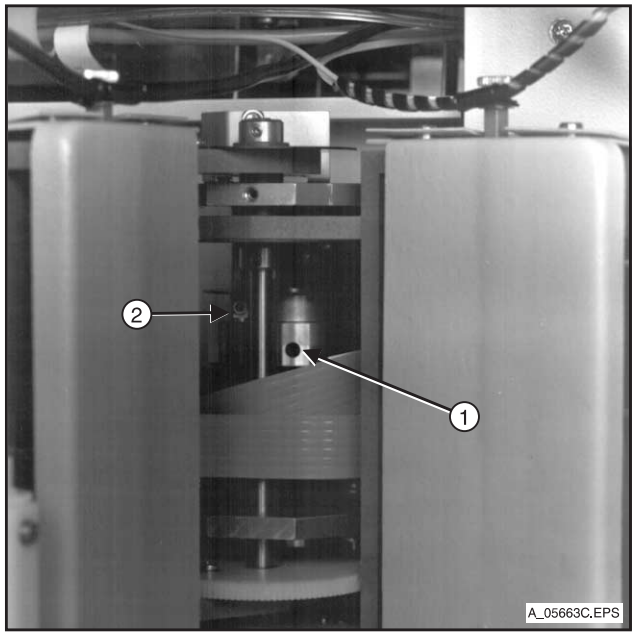
   (g) Tighten one rotary detent flag set screw.

(h) Rotate fine adjustment screw counterclockwise until sensor just toggles from ON to OFF. (Observe the SENSOR STATUS window on the system console.)

(i) Tighten second set screw.

(j) Verify the mixer is centered over reaction carousel cuvette.

(k) Verify sensor status toggles during slight rotary movement of mixer arm. (Observe the SENSOR STATUS window on the system console.)



1 - Rotary Detent Set Screw
2 - Fine Adjustment Screw

Figure 3-20. CX4 Reagent Mixer Rotary Alignment Screws

3.6.6 CX4 PROBE VERTICAL ALIGNMENT

1. Procedure Summary. This procedure automatically adjusts the vertical alignment of the reagent probe.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 3. Probe Vertical Alignment, or type 3, **ENTER**.
4. Special Instructions. None.

3.6.7 CX4 MIXER VERTICAL ALIGNMENT

1. Procedure Summary. This procedure automatically adjusts the vertical alignment of the reagent mixer.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 4. Mixer Vertical Alignment, or type 4, **ENTER**.
4. Special Instructions. None.

3.6.8 CX4 REAGENT CAROUSEL FLAG ALIGNMENT

1. Procedure Summary. This procedure aids the operator in aligning the reagent carousel.
2. Materials Required.

   Small and Large Allen Wrench Sets
   Phillips Screwdriver

3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 5. Reagent Carousel Flag Alignment, or type 5, **ENTER**.

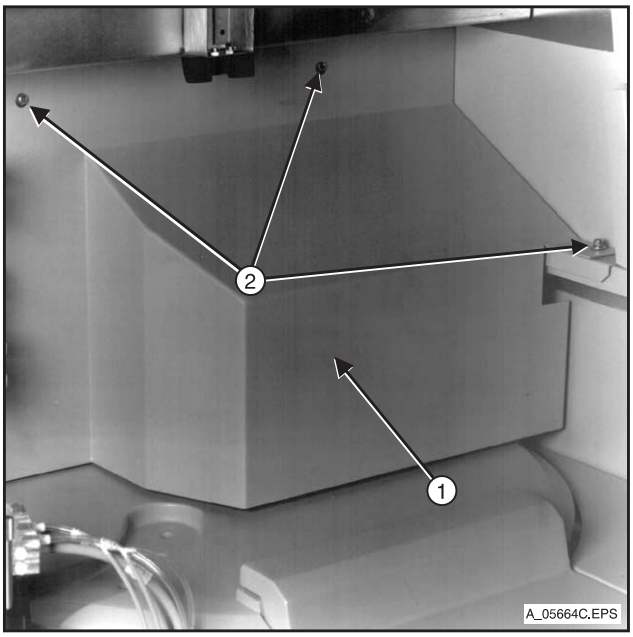
4. Special Instructions.

NOTE

Prior to beginning this procedure, remove the front reagent carousel motor cover.

(a) Clear area around reagent carousel.

(b) Move reagent probes left, away from reagent carousel.



1 - Reagent Carousel Motor Cover
2 - Retaining Screws

Figure 3-21. Reagent Carousel Motor Cover

(c) Loosen 4 motor mount screws.

(d) Rotate motor fully counterclockwise.

(e) Tighten motor screws.

(f) Rotate detent flag until sensor is ON at detent C and cartridge position 1 is closest to the load position. (Observe the SENSOR STATUS window on the system console.)

(g) Clear area around reagent carousel.

(h) Loosen 4 motor mount screws.

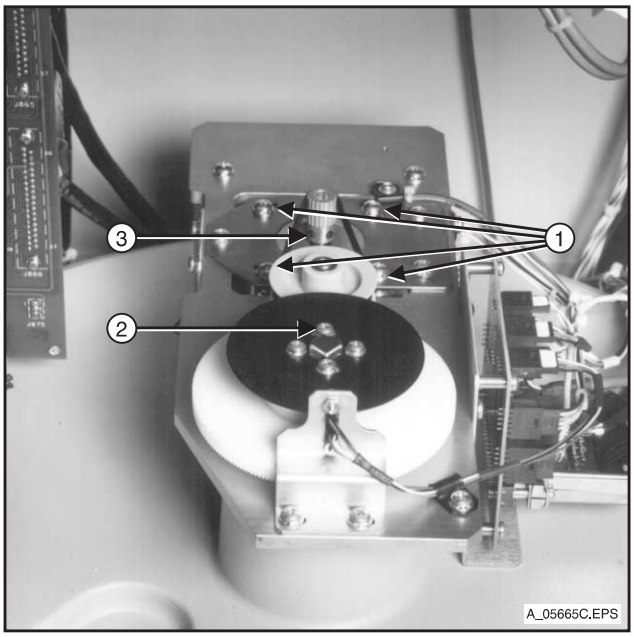
(i) Rotate motor clockwise until sensor is at ON/OFF threshold. (Observe SENSOR STATUS window on the system console.)

(j) Tighten motor screws.

(k) Clear area around reagent carousel.

(l) Loosen belt drive set screws.

(m) Rotate carousel rotor to position 1.



1 - Motor Mount Screws
2 - Home Sensor Disc Screw (Typical 4 Places)
3 - Belt Drive Set Screw (Typical 2 Places)

Figure 3-22. Reagent Carousel Motor

(n) Tighten belt drive set screws.

(o) Clear area around reagent carousel.

(p) Loosen home sensor disc screws and move disc fully clockwise.

(q) Adjust home sensor disc counterclockwise until sensor is at ON/OFF threshold. (Observe SENSOR STATUS window on system console.)

(r) Tighten home sensor disc screws.

(s) Clear area around reagent carousel.

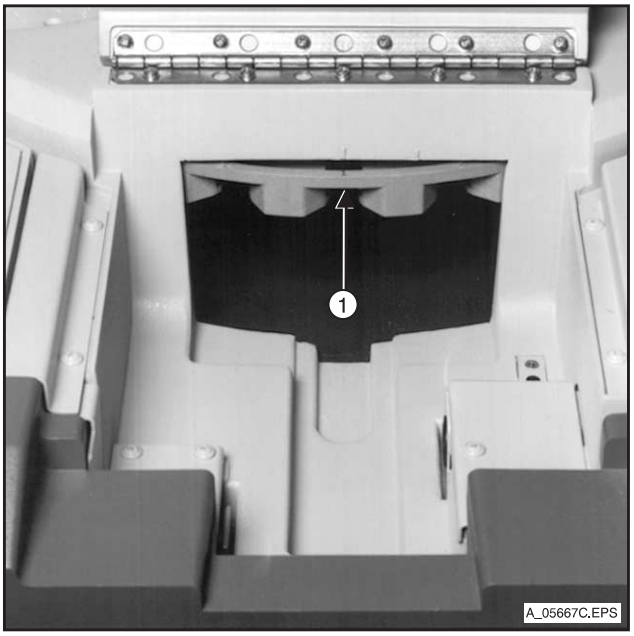
(t) Verify load mark is centered over position 1.

(u) Clear area around reagent carousel.

(v) Clear area around reagent probes.

1 - Detent C
2 - Reagent Belt Drive Set Screws

Figure 3-23. Detent C and Set Screws



1 - Position 1

Figure 3-24. Load Mark Centered Over Position 1

3.6.9 CX4 SYRINGE PUMP FLAG ALIGNMENT

1. Procedure Summary. This procedure automatically adjusts the alignment of the reagent pump.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 6. Syringe Pump Flag Alignment, or type 6, **ENTER**.
4. Special Instructions. None.

3.6.10 CX4 PROBE HEIGHT ADJUSTMENT

1. Procedure Summary. This procedure automatically adjusts the reagent probe height. The operator is requested to lower the probe as far as it will go, after which the probe will readjust its height by counting the steps required to elevate back to home position.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 7. Probe Height Adjustment, or type 7, **ENTER**.

NOTE

Prior to performing this procedure, remove Reaction Carousel cover.

4. Special Instructions.
   (a) Clear area around reagent probe and mixer.
   (b) Lower probe as far as possible into oval alignment hole (not cuvette).

Figure 3-25. Reagent Probe

3.6.11 CX4 MIXER HEIGHT ADJUSTMENT

1. Procedure Summary. This procedure automatically adjusts the reagent mixer height. The operator is requested to lower the mixer as far as it will go, after which the mixer will readjust its height by counting the steps required to elevate back to home position.
2. Materials Required. None.
3. Procedure Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set ALIGNMENT mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 6. Reagent System, or type 6, **ENTER**.
   (e) Cursor and **SELECT** 8. Mixer Height Adjustment, or type 8, **ENTER**.

NOTE

Prior to performing this procedure, remove reaction carousel cover.

4. Special Instructions.
   (a) Clear area around reagent probe and mixer.
   (b) Lower mixer as far as possible into oval alignment hole (not cuvette).

3.7 CX4 REACTION CAROUSEL SYSTEM

3.7.1 DESCRIPTION

The Reaction Carousel functional area tests the operation of the reaction carousel motion control, sensor operation, and the cuvette wash assembly.

NOTE

PRIMARY Mode tests should be run prior to any test in the EXTENDED Mode. If all PRIMARY Mode tests pass, refer to Paragraph 3.7.1.3 for additional EXTENDED Mode tests to be run. All PRIMARY Mode failures should be confirmed through EXTENDED Mode testing.

3.7.1.1 Error Conditions

The following error conditions are associated with this diagnostic module:

Reaction Carousel Temperature out of specification

Cuvette Wash Temperature out of specification

Reaction Carousel Motion Error

Analog Control Sensor Error

Cuvette Wash Assembly Motion Error

Wash Reservoir/Waste Container flood

Reaction Carousel out of alignment

Cuvette Wash Station Alignment

3.7.1.2 Modules

The following modules are tested under the REACTION CAROUSEL functional area:

Reaction Carousel
Cuvette Wash Assembly

3.7.1.3 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Reaction Carousel	3.7.2	
Homing Test	3.7.2.1	Primary, Extended
Start Up Reliability	3.7.2.2	Primary, Extended
Stepper/Sensor Correlation	3.7.2.3	Primary, Extended
Manual Movement Test	3.7.2.4	Extended
Rotate to Specified Position	3.7.2.5	Extended
Temperature Test	3.7.2.6	Primary, Extended
Cuvette Wash	3.7.3	
Hydropneumatic Sensor Test	3.7.3.1	Extended
Cuvette Wash Test	3.7.3.2	Extended
Temperature Test	3.7.3.3	Extended
Reaction Carousel Alignment	3.7.4.	Alignment
Wash Station Alignment	3.7.5	Alignment
Reaction Carousel Sensor Margins	3.7.6	Alignment

3.7.2 CX4 REACTION CAROUSEL TESTS

3.7.2.1 Homing Test

1. Test Summary. The Reaction Carousel Homing Test initiates a reaction carousel home sequence to determine proper alignment, sensor operation and carousel rotation.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.
   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.
   (f) Cursor and **SELECT** 1. Homing Test, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Homing Test. If the test fails again, continue to the next corrective action step.
   (a) Perform the Manual Movement test, Paragraph 3.7.2.4.
   (b) Perform the Rotate to Specified Position test, Paragraph 3.7.2.5.
   (c) Perform Reaction Carousel Alignment, Paragraph 3.7.4.
   (d) Call the Clinical Support Center or your local Beckman representative.

3.7.2.2 Start-Up Reliability Test

1. Test Summary. The Start-Up Reliability Test verifies proper carousel rotation with respect to the motor and the carousel. The carousel makes a series of short, quick rotational moves. A motion error on any one move causes the test to fail.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.
   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.
   (f) Cursor and **SELECT** 2. Start-Up Reliability Test, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Start-up Reliability Test. If the test fails again, continue to the next corrective action step.
   (a) Perform Reaction Carousel Alignment, Paragraph 3.7.4.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.7.2.3 Stepper/Sensor Correlation Test

1. Test Summary. The Stepper/Sensor Correlation Test verifies Reaction Carousel sensor operation and alignment by counting the number of motor steps required to activate the reaction carousel home sensors. The system compares the number of steps counted to the expected and determines whether the test passed or failed.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen.
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

(e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.

(f) Cursor and **SELECT** 3. Stepper/Sensor Test, or type 3, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Stepper/Sensor Correlation Test. If the test fails again, continue to the next corrective action step.

   (a) Perform Reaction Carousel Manual Movement test, Paragraph 3.7.2.4.

   (b) Perform Reaction Carousel Alignment, Paragraph 3.7.4.

   (c) Call the Clinical Support Center or your local Beckman representative.

3.7.2.4 Manual Movement Test

1. Test Summary. The Reaction Carousel Manual Movement Test provides the ability to verify reaction carousel sensor operation by manually rotating the reaction carousel to turn the sensors ON and OFF. The operator verifies operation by checking that the status given on the screen reflects the true state of the sensor.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

   (e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.

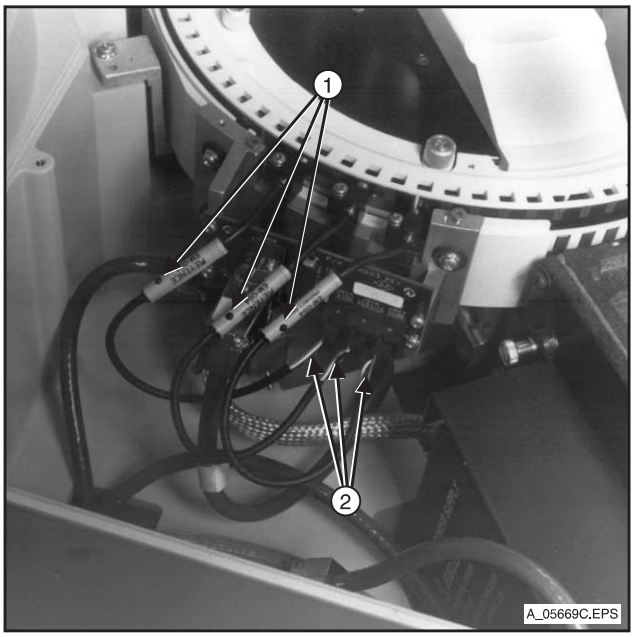
   (f) Cursor and **SELECT** 4. Manual Movement Test, or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Manual Movement Test. If the test fails again, continue to the next corrective action step.

   (a) Verify proper cable connections on all reaction carousel sensors.

   (b) Repeat the test and verify sensor LEDs on sensor cables light when sensor is ON.

   (c) Call the Clinical Support Center or your local Beckman representative.



1 - LEDs on Sensor Cables
2 - Sensor Cable Connections

Figure 3-26. Reaction Carousel Sensor Cables

3.7.2.5 Rotate To Specified Position Test

1. Test Summary. The Rotate to Specified Position Test verifies carousel alignment by allowing the operator to drive the carousel to a selected cuvette location. The operator enters a cuvette number to be rotated to the reagent dispense position. The operator then visually checks that the cuvette requested is rotated to the dispense position.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

(e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.

(f) Cursor and **SELECT** 5. Rotate to Specified Position Test, or type 5, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Rotate to Specified Position Test. If the test fails again, continue to the next corrective action step.

(a) Perform Reaction Carousel Alignment, Paragraph 3.7.4.

(b) Call the Clinical Support Center or your local Beckman representative.

3.7.2.6 Temperature Test

1. Test Summary. The Temperature Test displays the temperature of the reaction wheel, cuvette wash water, and rinse water heaters.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

(e) Cursor and **SELECT** 1. Reaction Carousel, or type 1, **ENTER**.

(f) Cursor and **SELECT** 6. Temperature Test, or type 6, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Temperature Test. If the test fails again, continue to the next corrective action step.

(a) Perform the Reaction Carousel Temperature Test, Paragraph 3.4.2.1.

(b) Call the Clinical Support Center or your local Beckman representative.

3.7.3 CX4 CUVETTE WASH ASSEMBLY TESTS

3.7.3.1 Hydropneumatic Sensor Test

1. Test Summary. The Cuvette Wash Assembly Hydropneumatic Sensor Test displays the fluid levels of the wash reservoirs, wash concentrate, vacuum liquid trap, and the sump waste as the container sensors report them. In addition, DI water purity/pressure, air pressure, and the vacuum levels are reported. The operator visually verifies the reported status of each. The test fails if a sensor status does not agree with the actual condition.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

(a) Press **F2 SETUP OPTIONS** to select operation mode.

(b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

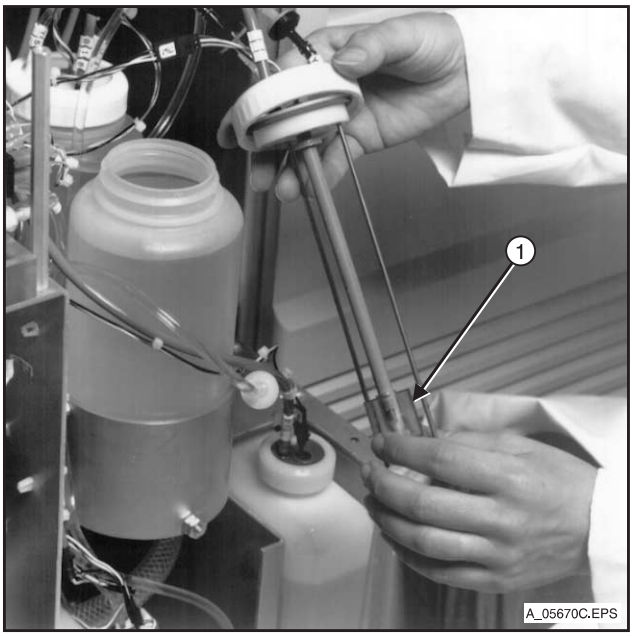
(d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

(e) Cursor and **SELECT** 2. Cuvette Wash Assembly, or type 2, **ENTER**.

(f) Cursor and **SELECT** 1. Hydropneumatic Sensor Test, or type 1, **ENTER**.

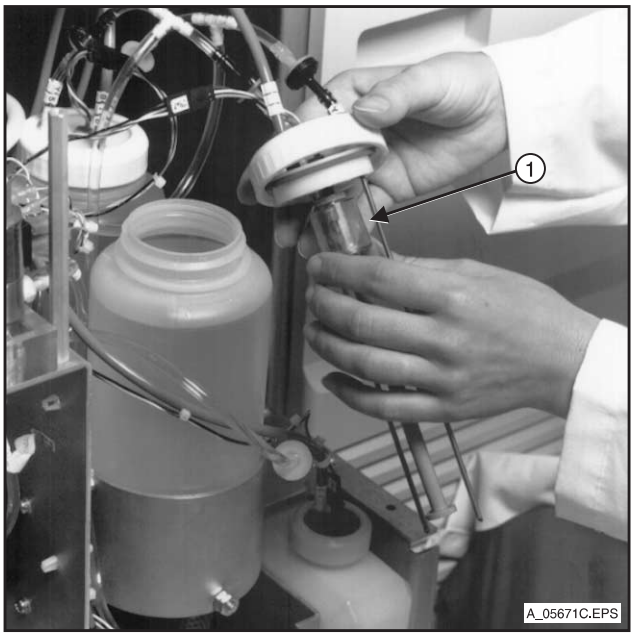
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Hydropneumatic Sensor Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Wash Bottle 1, Wash Bottle 2, Sump Waste, Wash Concentrate or Vacuum Liquid Trap levels do not agree with status shown on system console.	1. Manipulate sensor up and down to verify sensor status changes from EMPTY to OK to FULL. **NOTE** Perform Paragraph 3.8.3.1 to turn off the compressor prior to opening a wash bottle. Press F7 STATUS MONITOR to view sensor response. 2. Verify Sensor connections on Hydropneumatic Interface Board. 3. Call the Clinical Support Center or your local Beckman representative.



1 - Float Switch in EMPTY Position

Figure 3-27. Float Switch



1 - Float Switch in FULL Position

Figure 3-28. Float Switch

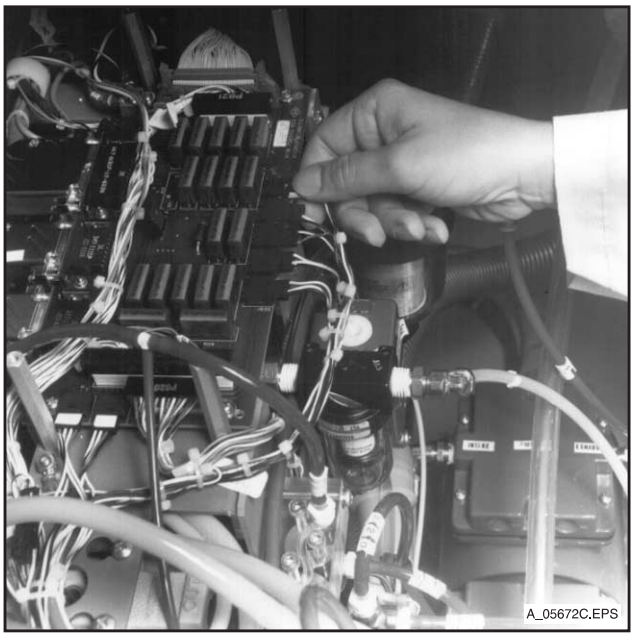
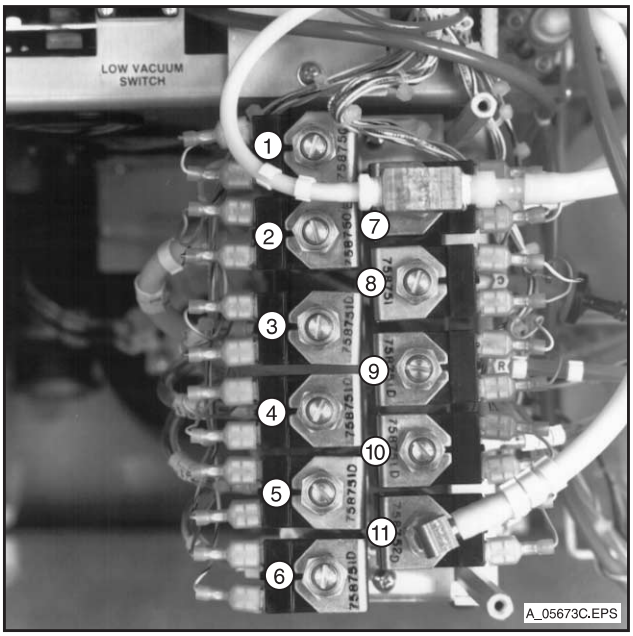


Figure 3-29. Hydropneumatic Interface Board

3.7.3.2 Cuvette Wash Test

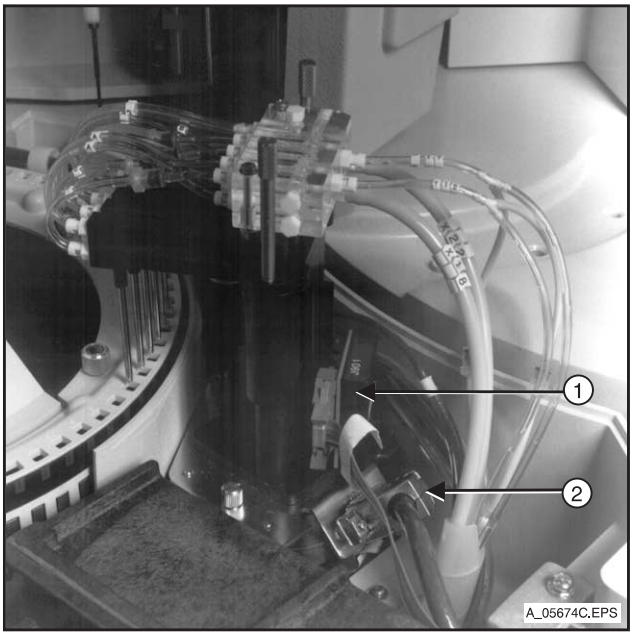
1. Test Summary. The Cuvette Wash Test performs a cuvette wash operation on the cuvettes and moves the reaction carousel two cuvette positions counterclockwise. The operator confirms motions and fluid flow in each wash probe and checks for any dripping from the cuvette wash station. The test fails if no fluid flows through a line or if a cuvette overflows during this test.
2. Materials Required. Adequate wash solution in at least one wash reservoir is required.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.
   (e) Cursor and **SELECT** 2. Cuvette Wash Assembly, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 2. Cuvette Wash Test, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Cuvette Wash Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. No wash or DI water flowing through lines or dripping probe.	1. View Status monitor to verify volumes are adequate. 2. Ensure that flow lines are connected and unblocked. 3. The check valves are suspected; call the Clinical Support Center or your local Beckman representative.
2. Overflowing cuvettes	1. View STATUS MONITOR to check vacuum level. 2. Check vacuum lines for loose fittings or leaks. 3. Check cuvette wash vacuum valve connector. 4. The check valve is suspected, call the Clinical Support Center or your local Beckman representative.
3. No motion.	1. Check cuvette wash station power connector. 2. Perform alignment, Paragraph 3.7.5. 3. Perform MSC diagnostics, Paragraph 3.2.3. 4. Call the Clinical Support Center or your local Beckman representative.
4. Probes not centered over cuvette.	1. Perform alignment, Paragraph 3.7.5



1 - Sip Valve
2 - Cuvette Wash Vacuum
3 - Sample External Probe Wash
4 - Reagent External Probe Wash
5 - Wash to Cuvette Wash
6 - (Not in use)
7 - Liquid trap Dump Valve
8 - Wash Mix Valve
9 - DI Water Mix Valve
10 - DI Water to Cuvette Wash
11 - Degasser Valve (Syringe Pump Valve)

Figure 3-30. Wash Mix Valves



1 - Sensor Block
2 - Power Connector

Figure 3-31. Cuvette Wash Station Connectors

3.7.3.3 Temperature Test

1. Test Summary. The Temperature Test displays the temperature of the reaction carousel, cuvette wash water, and cuvette rinse water heaters.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.
   (e) Cursor and **SELECT** 2. Cuvette Wash Assembly, or type 2, **ENTER**.
   (f) Cursor and **SELECT** 3. Temperature Test, or type 3, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Temperature Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reaction Carousel temperature out of range.	1. Perform Reaction Carousel Temperature test, Paragraph 3.4.2.1.
2. Cuvette Wash Water temperature out of range.	1. Perform Cuvette Wash Water Temperature test, Paragraph 3.4.3.1.
3. Cuvette Rinse Water temperature out of range.	1. Perform Cuvette Rinse Water Temperature test, Paragraph 3.4.4.1.

3.7.4 CX4 REACTION CAROUSEL ALIGNMENT

1. Procedure Summary. This procedure allows the operator to align the reaction carousel and sensors. If reaction carousel sensor positions are adjusted, Analog Control Flash Delay (Paragraph 3.3.6) must be performed.

2. Materials Required.

   Alignment Plate with Dowel Pins
   Tapered Alignment Pin
   Large Allen Wrench
   0.030-inch Feeler Gauge

3. Test Access. From the diagnostics MAIN MENU screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

   (e) Cursor and **SELECT** 1. Reaction Carousel Alignment, or type 1, **ENTER**.

4. Special Instructions.

   (a) Move cranes away and install alignment plate on tub using pins in plate.

NOTE

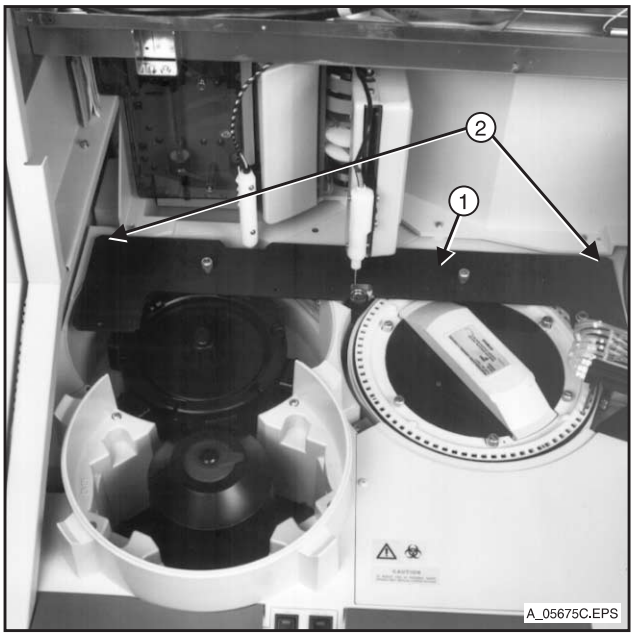
Older style alignment plates use removable dowel pins to install the plate. The newer alignment plate has permanent pins.

CAUTION

Loosening holding screws more than 2 turns may cause the carousel motor to drop down, requiring replacement.

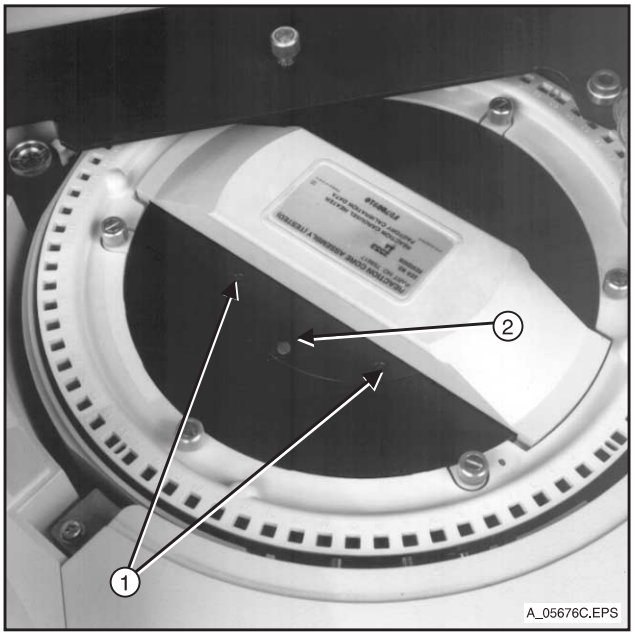
   (b) Loosen 4 holding screws on reaction carousel hub counterclockwise 2 turns.

   (c) Rotate eccentric adjustment screw until screw slot is pointing to the center of the hub.



1 - Alignment Plate
2 - Dowel Pins

Figure 3-32. Alignment Plate



1 - Holding Screw (Typical 4 Places)
2 - Eccentric Adjustment Screw

Figure 3-33. Reaction Carousel Hub

   (d) Rotate reaction carousel and align cuvette #64 under alignment pin hole RW ALIGN using tapered alignment pin.

NOTE

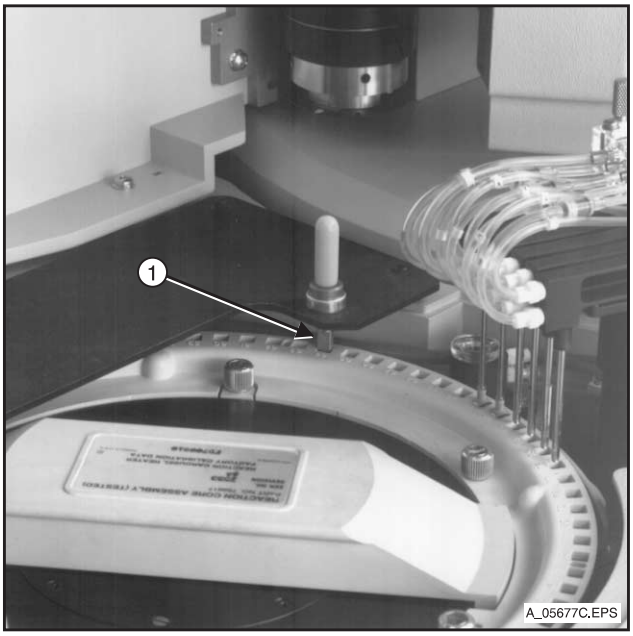
Older alignment plates do not have the RW ALIGN label.

(e) Remove pin and clear the area around reaction carousel.

(f) Insert alignment pin into alignment pin hole RW ALIGN.

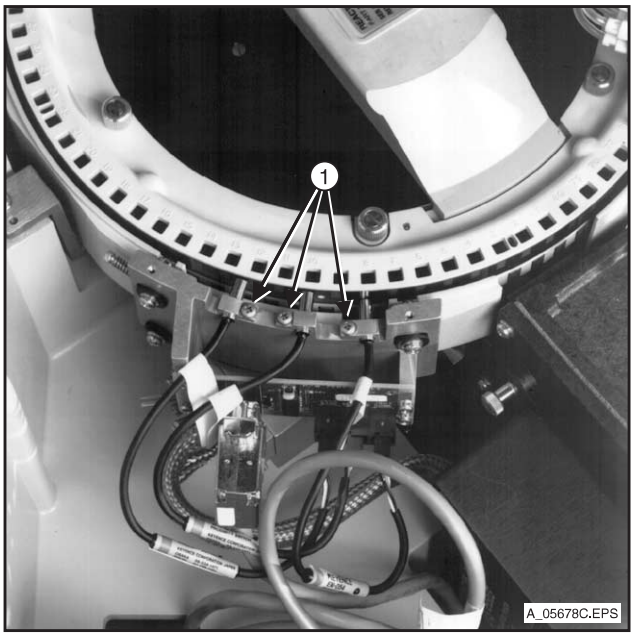
(g) Rotate eccentric adjustment screw until alignment pin is centered in cuvette #64.

(h) Tighten 4 holding screws on reaction carousel hub clockwise.



1 - Alignment Pin in Cuvette #64

Figure 3-34. Alignment Pin



1 - Sensor Clamp Screws

Figure 3-35. Reaction Carousel Sensor Clamp Screws

(i) Loosen 3 sensor plate retaining screws. [At this time, omit above step and press the ENTER key.]

(j) Loosen 3 sensor clamp screws.

(k) Install sensor gap adjustment tool. [At this time, omit above step and press the ENTER key.]

(l) Rotate 2 vertical adjustment set screws until gap adjustment tool is flush with top of cuvette retaining ring. [At this time, omit above step and press the ENTER key.]

(m) Tighten 3 sensor plate retaining screws. [At this time, omit above step and press the ENTER key.]

(n) Push sensors up against feeler gauge to set 0.02 inch gap and tighten 3 sensor clamp screws.

(o) Remove feeler gauge.

(p) Loosen 3 sensor plate retaining screws.

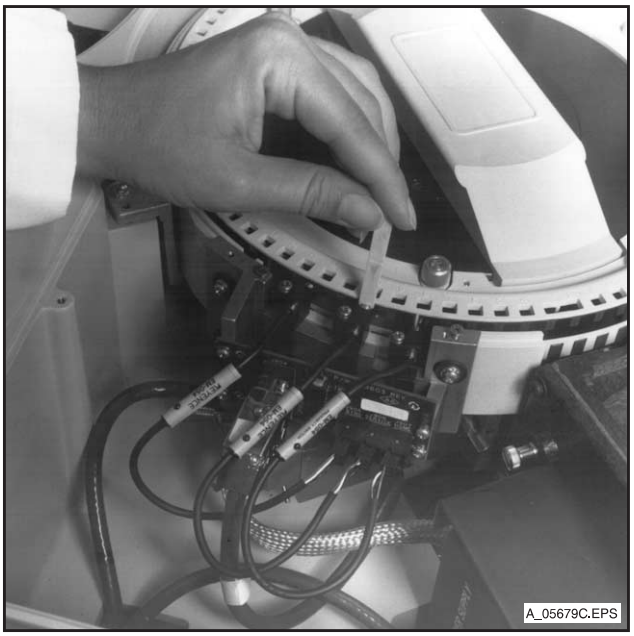


Figure 3-36. Removing Feeler Gauge

(q) Position sensor plate so that service (middle) sensor is centered in the detent gap and the home sensor is in the home gap.

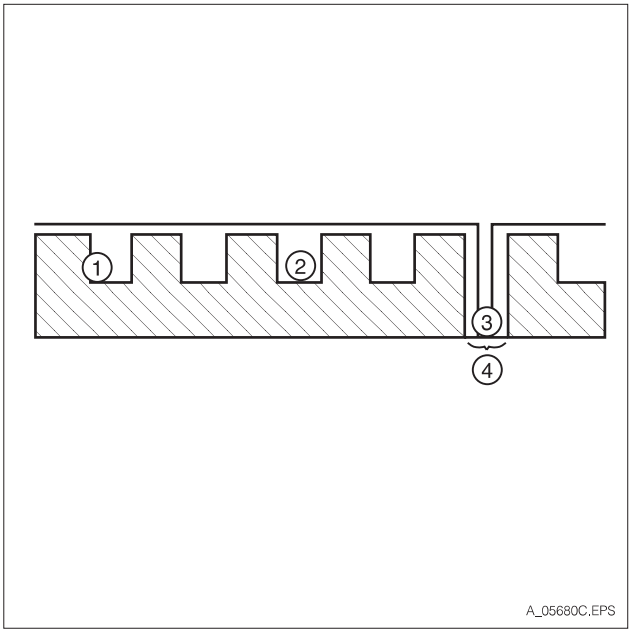
(r) Tighten 3 sensor plate retaining screws.

(s) Remove alignment pin.

(t) Remove alignment plate.

(u) Verify 0.02-inch gap.

(v) Perform diagnostics, Paragraph 3.7.6.



1 - Sync Sensor
2 - Service Sensor
3 - Home Sensor
4 - "Home" Gap

Figure 3-37. Reaction Carousel Sensors

NOTE

A motion error during verification of free rotation indicates poor sensor adjustment. The procedure must be repeated to correctly adjust sensor margins.

3.7.5 CX4 WASH STATION ALIGNMENT

1. Procedure Summary. This procedure allows the operator to align the cuvette wash station.

2. Materials Required.

   3/32 Hex Wrench
   .050 Hex Wrench
   Slotted Screw Driver
   0.03-inch Feeler Gauge
   Small Mirror

3. Procedure Access.

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

   (e) Cursor and **SELECT** 2. Wash Station Alignment, or type 2, **ENTER**.

4. Special Instructions.

NOTE

It is recommended NOT to move cranes out of the way since power to cranes is still on.

(a) Remove cuvette wash and reaction carousel covers. Clear area around wash station and reaction carousel.

(b) Loosen the two knurled screws holding down manifold/probe top assembly and remove top assembly.

(c) Slightly loosen the two hex screws through the holes in the top of the base assembly.

(d) Replace the top assembly and secure with the knurled screws.

(e) Use up/down arrows to raise or lower wash assembly to bring probes close to cuvette openings.

(f) Using mirror, adjust position of cuvette wash base until probes are centered over the cuvette openings.

(g) Hold the base firmly. Loosen the two large knurled screws holding down manifold/probe top assembly and remove top assembly.

(h) Tighten the two hex adjustment screws through the holes in the top of the base assembly.

(i) Replace the top assembly and secure with the knurled screws.

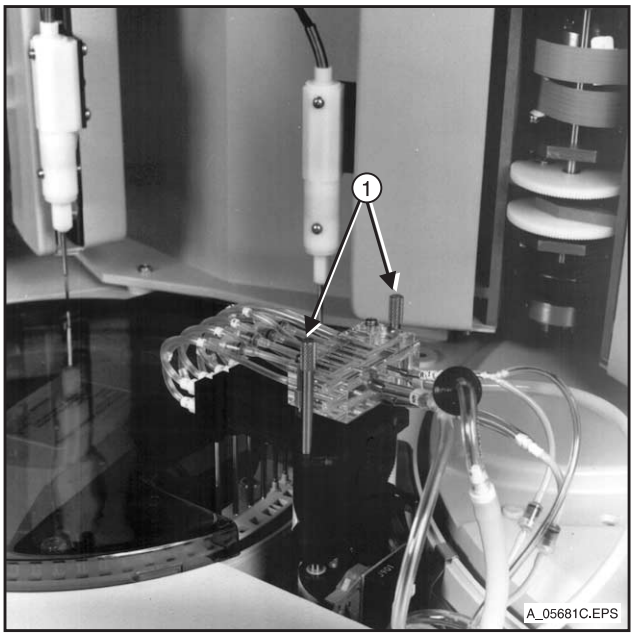
(j) Verify probes are still centered over cuvettes. If not press **F1** and repeat Steps (b) through (i).

(k) Use the up/down arrows and feeler gauge (P/N 759473) to set 0.03-inch deflection.

CAUTION

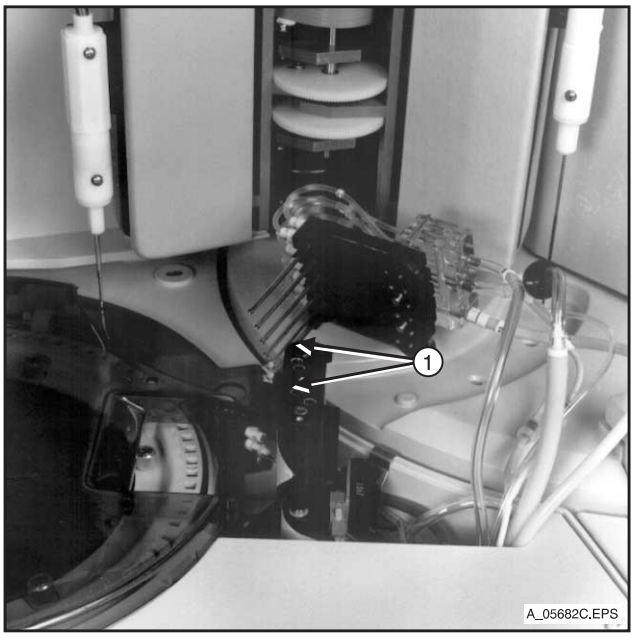
Cuvette breakage may occur if cuvette wash station is excessively forced down with the down arrow key.

(l) Using a .050 hex wrench, loosen sensor block assembly screw.



1 - Knurled Screws

Figure 3-38. Cuvette Wash Station



1 - Holes to Reach Hex Screws

Figure 3-39. Cuvette Wash Station Top Assembly Removed

(m) Adjust block vertically until ON/OFF threshold is achieved. (Observe the SENSOR STATUS given on the system console.)

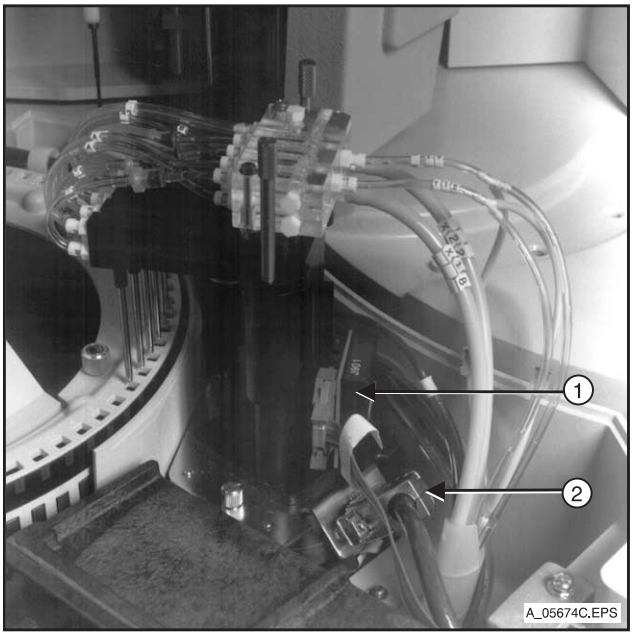
(n) Tighten sensor block assembly screw. (Observe the SENSOR STATUS given on the system console and ensure the status does not change while tightening the screw.)

(o) Verify 0.03-inch probe deflection. Press **F1** and repeat Steps (k) through (o) if necessary.

NOTE

A probe deflection of greater than 0.03-inch may result in cuvette breakage. A probe deflection of less than 0.03-inch will result in incomplete cuvette drainage. If probe deflection is not 0.03-inch, repeat procedure.

(p) Replace the cuvette wash and reaction carousel covers.



1 - Sensor Block
2 - Power Connector

Figure 3-40. Cuvette Wash Station Connectors

3.7.6 CX4 REACTION CAROUSEL SENSOR MARGINS

1. Procedure Summary. This procedure allows the operator to verify correct positioning of the reaction carousel sensors.

2. Materials Required.

   Feeler Gauge
   Slotted Screwdriver

3. Procedure Access.

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set ALIGNMENT mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 7. Reaction Carousel System, or type 7, **ENTER**.

   (e) Cursor and **SELECT** 3. Reaction Carousel Sensor Margins, or type 3, **ENTER**.

   (f) If probes and cuvette wash tower are out of the way, press **Y** in response to the on-screen prompt. If they are not, press **N**, then **HOME**, and repeat the preceding steps.

NOTE

The reaction carousel must be free from obstructions prior to running this procedure. The system will not look at the position of any other hardware, and probe damage could occur if probes are in a down position.

   (g) Press **F2 HOME SERV**.

4. Corrective Action. Review the resulting printout. The numbers in the BEFORE G. P. (Golden Phase) and AFTER G. P. columns are optimally 1s and 2s. If they are not, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Reaction Carousel Sensor Margins test. If the test fails again, continue to the next corrective action step.

   (a) If the numbers on the printout are 1s and 2s, procedure passes.

   (b) If the numbers on the printout are 1s, 2s, and 3s:

      i. Loosen the slotted screw holding the HOME sensor.

ii. Using the feeler gauge, move the HOME sensor to a 0.020-inch gap from the reaction carousel timing band.

iii. Tighten the slotted screw holding the HOME sensor.

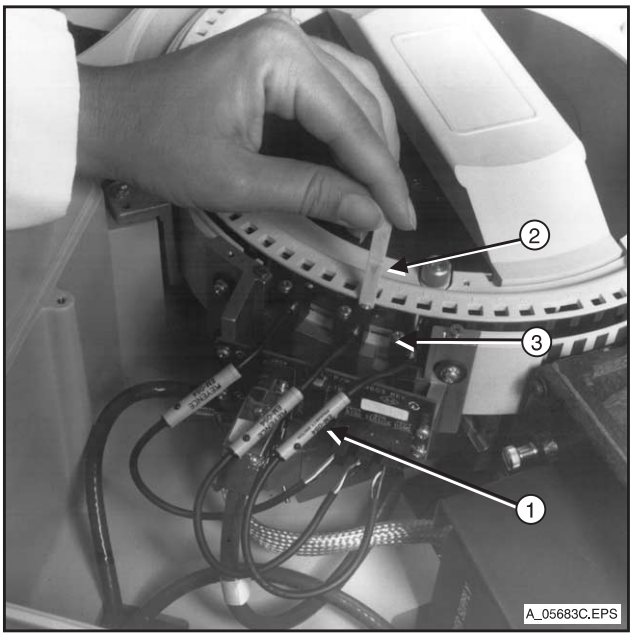
iv. Using the feeler gauge, verify that the SYNC and SERVICE sensors are set to a 0.020-inch gap from the reaction carousel timing band. If not, repeat Steps (b) i, ii and iii to adjust appropriate sensor.

v. Press **F7 RELEASE RW MOTOR**.

vi. Manually rotate the reaction carousel 360° to ensure that the adjusted home probe does not hit the reaction carousel timing band. The LEDs should toggle on and off.

vii. Press **F7** to restore power to the reaction carousel.

(c) If the numbers on the printout are 3s, 4s, or 0s, press **F3 HOME SYNC**. When printing is complete, press the **F4 SERVICE ALL CUV**. Save printouts and call the Clinical Support Center or your local Beckman representative.



1 - HOME Sensor
2 - Feeler Gauge
3 - Slotted Screw

Figure 3-41. Reaction Carousel Sensor Adjustment

NOTE

After a successful Reaction Carousel Sensor Margins test, a flash delay adjustment procedure MUST be performed.

3.8 CX4 HYDROPNEUMATIC SYSTEM

3.8.1 DESCRIPTION

The Hydropneumatic functional area validates the operation of hydropneumatic hardware that controls the flow and distribution of DI water, concentrated wash solution, diluted wash solution, pressurized air, vacuum and waste solutions.

3.8.1.1 Modules

The following modules are tested in the Hydropneumatic System functional area:

Hydro System
Pneumatic System
Waste Removal System

3.8.1.2 Error Conditions

The following error conditions may be associated with this functional area:

Air Pressure Not In Range
Motion Error –Autoloader Up/Down
Motion Error –DI Mixer Valve
Motion Error –DI Water to Cuvette Wash
Motion Error –Cuvette Vacuum
Waste Bucket Full
Motion Error Sump Pump
Motion Error –Vacuum Reservoir
Motion Error –Wash Mixer Valve
Wash Concentrate and/or Probe Rinse Solution Low
Flooding cuvettes
Water Pressure Failure
Water Pressure Too Low
Water Pressure Too High
Vacuum Pressure Too Low
Vacuum Liquid Trap Too High
Incorrect wash bottle level sense
Failure to calibrate
System imprecision
Occluded CX4 reagent or sample probes
Reagent or sample carryover

3.8.1.3 Test Location

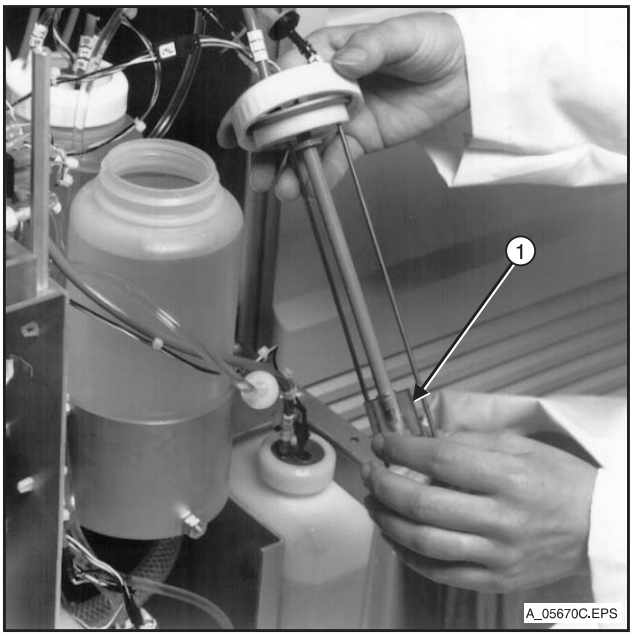
TEST NAME	PARAGRAPH	TEST MODE
Hydro System	3.8.2	
Hydro System		Primary
Wash Reservoir #1		Primary
Wash Reservoir #2		Primary
Wash Concentrate		Primary
DI Water Pressure		Primary
DI Water Purity		Primary
Float Switches Level Test	3.8.2.1	Extended
Mix Wash Solution Test	3.8.2.2	Extended
External Probe Wash Test	3.8.2.3	
Internal Probe/Scrub Bubble Test	3.8.2.4	Extended
Cuvette Wash Test	3.8.2.5	Extended
Pneumatic System	3.8.3	
Air Pump/Sensor		Primary
Vacuum Pump/Sensor		Primary
Compressor/Vacuum Pump Test	3.8.3.1	Extended
Probe Air Strip	3.8.3.2	Extended
Scrub Bubble Test	3.8.3.3	Extended
Autoloader Test	3.8.3.4	Extended
Waste Collection System	3.8.4	
Vacuum Liquid Trap		Primary
Sump Level		Primary
Float Switches Level Test	3.8.4.1	Extended
Sump Pump Test	3.8.4.2	Extended
Vacuum Liquid Trap Test	3.8.4.3	Extended
Automated Hydropneumatic Decontamination	3.8.5	
Decontaminate CX5 System Instrumentation	3.8.5.1	Extended
Decontaminate CX4 System Instrumentation (CX7 and CX4)	3.8.5.2	Extended

3.8.2 CX4 HYDRO SYSTEM

3.8.2.1 Float Switches Level Test

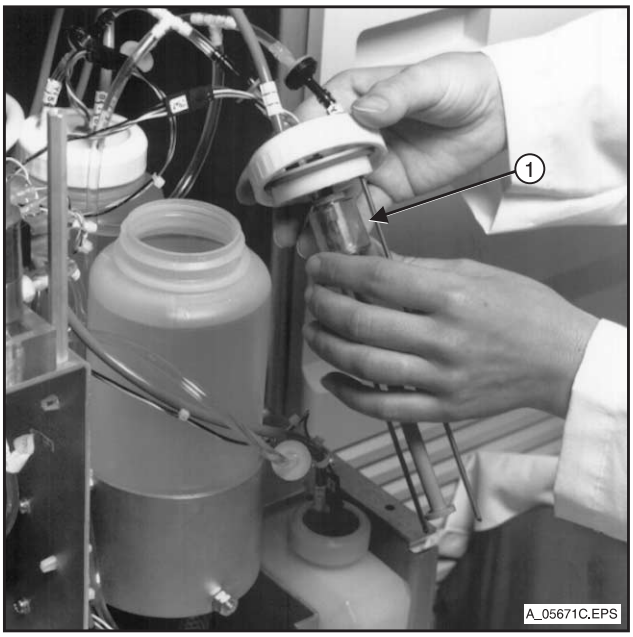
1. Test Summary. The Hydro System Float Switches Level Test performs a check on the float switches (fluid level sensors) in the Wash Bottle #1, Wash Bottle #2, ISE Wash, and the Wash Concentrate and/or probe rinse solution containers. In addition, the deionized water pressure and deionized water purity are checked. The status of the float switches for the liquid containers will be either, FULL, OK or EMPTY. The deionized water purity will be either GOOD or BAD, and the deionized water pressure will be either OK or FAIL. The operator visually verifies that the float switch levels recorded on the screen agree with the actual level of liquid in the containers or pressure registered on the gauge.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.
   (e) Cursor and **SELECT** 1. Hydro System, or type 1, ENTER.
   (f) Cursor and **SELECT** 1. Float Switches Level Test, or type 1, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Float Switches Level Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Wash Bottle #1 Level, Wash Bottle #2 Level, or Wash Concentrate Level does not agree with actual status.	1. Perform Paragraph 3.8.3.1 to turn off compressor and manually move the float up and down and check that the status changes from EMPTY to OK to FULL. Press the **F7 STATUS MONITOR** to view sensor response. 2. Check for fluid spills and ensure adequate sensor plug contacts on the hydropneumatics interface board. 3. Call the Clinical Support Center or your local Beckman representative.
2. Water Pressure low.	1. Verify DI Water source valve is ON. 2. Check connectors on reservoir. 3. Check lines for leaks, loose fittings. 4. Call the Clinical Support Center or your local Beckman representative.
3. Deionized Water Purity BAD.	1. Perform Cuvette Wash Test (Paragraph 3.7.3.2) to prime DI water. 2. Turn off DI water supply to the instrument and call the Clinical Support Center or your local Beckman representative.



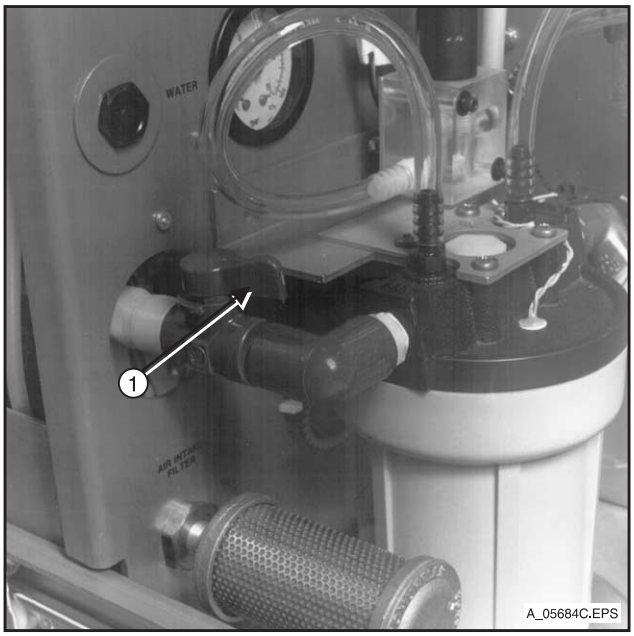
1 - Float Switch in EMPTY Position

Figure 3-42. Float switch



1 - Float Switch in FULL Position

Figure 3-43. Float Switch



1 - ON Position

Figure 3-44. DI Water Source Valve

3.8.2.2 Mix Wash Solution Test

1. Test Summary. The Mix Wash Solution Test will fill a requested wash bottle with wash solution. This procedure may be used to verify the operation of the wash bottle valves or to fill the particular wash bottle while operating the diagnostics software.
2. Materials Required. Adequate Wash concentrate is required to perform this procedure.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.
   (e) Cursor and **SELECT** 1. Hydro System, or type 1, **ENTER**.
   (f) Cursor and **SELECT** 2. Mix Wash Solution Test, or type 2, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Mix Wash Solution Test. If the test fails again, continue to the next corrective action step.

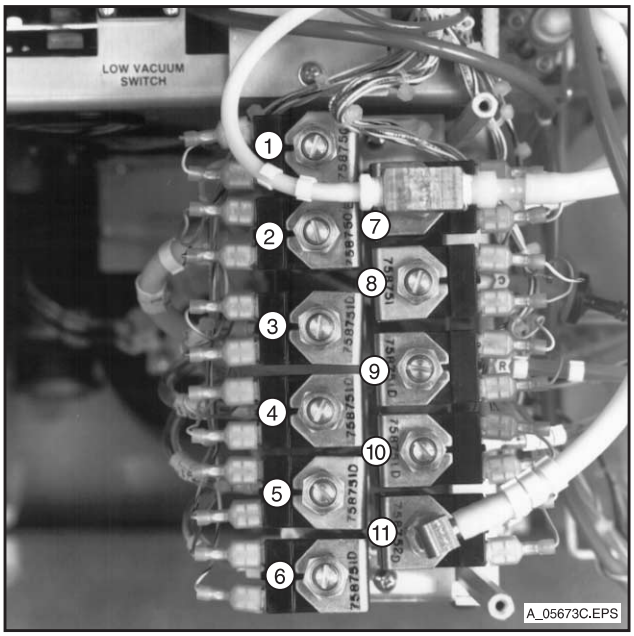
(a) View STATUS MONITOR to verify adequate deionized water pressure. Adjust if necessary.

(b) View STATUS MONITOR to verify adequate air pressure.

(c) The mix wash reservoir valve is suspected, call the Clinical Support Center or your local Beckman representative.

3.8.2.3 External Probe Wash Test

1. Test Summary. The External Probe Wash Test verifies the operation of the mix bottle valves, reagent probe wash valve and the sample probe wash valve. The operator is requested to turn on or off a selected valve and visually check the probe wash station for operation. The operator will be able to hear the valve click as it is turned on or off.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.
   (e) Cursor and **SELECT** 1. Hydro System, or type 1, **ENTER**.
   (f) Cursor and **SELECT** 3. External Probe Wash Test, or type 3, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the External Probe Wash Test. If the test fails again, continue to the next corrective action step.
   (a) Verify adequate deionized water pressure.
   (b) Verify valve connector on the liquid valve manifold.
   (c) A valve is suspected, call the Clinical Support Center or your local Beckman representative.



1 - Sip Valve
2 - Cuvette Wash Vacuum
3 - Sample External Probe Wash
4 - Reagent External Probe Wash
5 - Wash to Cuvette Wash
6 - (Not in use)
7 - Liquid Trap Dump Valve
8 - Wash Mix Valve
9 - DI Water Mix Valve
10 - DI Water to Cuvette Wash
11 - Degasser Valve (Syringe Pump Valve)

Figure 3-45. Wash Mix Valves

3.8.2.4 Internal Probe/Scrub Bubble Test

1. Test Summary. The Internal Probe/Scrub Bubble Test verifies the operation of the internal wash and reagent bubbler valves and checks for occlusion of the reagent and sample probes. The operator turns on the internal wash valve and visually verifies a stream of water coming from the probe selected. A stream of water that is not straight down indicates a partial occlusion or a bent probe. Reagent Bubbler valve operation is confirmed through the presence of air bubbles in the reagent probe line after the valve is turned “OFF”.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

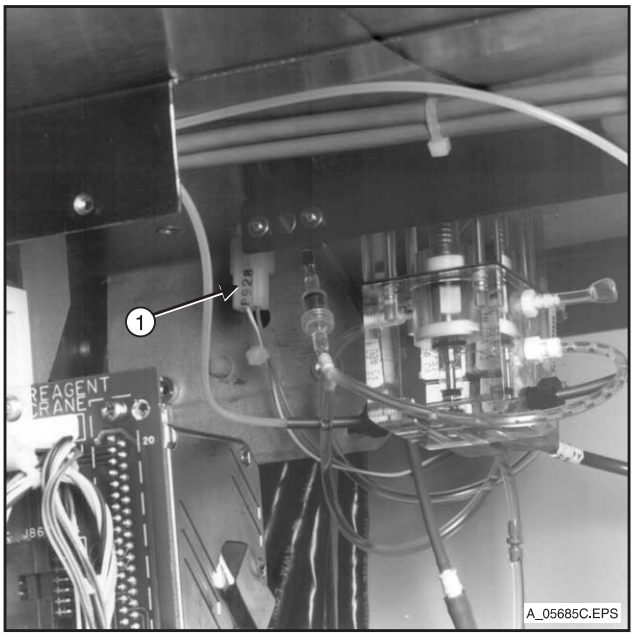
(d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

(e) Cursor and **SELECT** 1. Hydro System, or type 1, **ENTER**.

(f) Cursor and **SELECT** 4. Internal Probe/ Scrub Bubble Test, or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Internal Probe/Scrub Bubble Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. No water stream flowing from either probe.	1. Verify adequate DI water pressure. 2. Perform Probe maintenance, Section 9, in Operating Instructions. 3. Call the Clinical Support Center or your local Beckman representative.
2. Water stream flowing but is not straight down.	1. Perform Probe maintenance, Section 9, in Operating Instructions. 2. Call the Clinical Support Center or your local Beckman representative.
3. Bubbles in the reagent line.	1. Verify all fittings for reagent probe line are tight. 2. Prime internal probe wash. 3. If bubbles remain in line, call the Clinical Support Center or your local Beckman representative.
4. Reagent Bubbler Valve does not operate.	1. Remove Reagent Carousel Motor cover. (Refer to Paragraph 3.6.8.) 2. Check the connector on Bubbler cable. 3. The Reagent Bubbler Valve or board connection is suspected, call the Clinical Support Center or your local Beckman representative.



1 - Bubbler Valve Connector

Figure 3-46. Reagent Bubbler Valve Connector

3.8.2.5 Cuvette Wash Test

1. Test Summary. The Cuvette Wash Test confirms the operation of the following valves by allowing the operator to turn them ON and OFF and visually verifying fluid movement through various lines on the cuvette wash station: Cuvette Vacuum Valve, Sip Valve, DI Water Cuvette Wash Valve, and the Wash to Cuvette Wash Valve. In addition, the operator may raise and lower the Cuvette Wash Station to evaluate Cuvette Wash Station movement and alignment.

2. Materials Required. Adequate wash solution in at least one wash reservoir.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

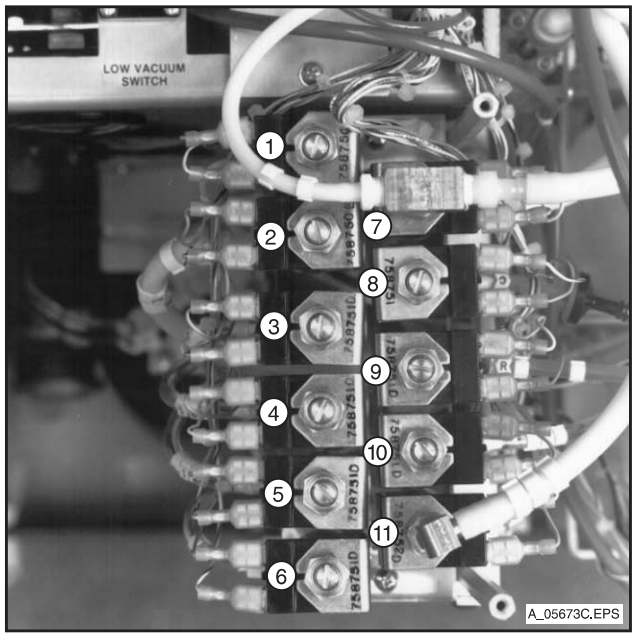
   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

   (e) Cursor and **SELECT** 1. Hydro System, or type 1, **ENTER**.

   (f) Cursor and **SELECT** 5. Cuvette Wash Test, or type 5, **ENTER**.

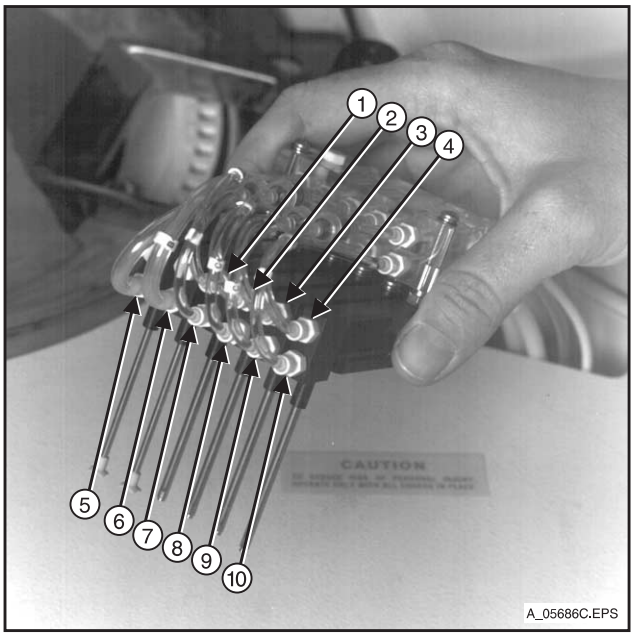
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Cuvette Wash Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Cuvette Vacuum Valve, Sip Valve, DI water Cuvette Valve, or Wash to Cuvette Wash Valve are not operational.	1. View STATUS MONITOR to verify adequate air pressure. 2. Verify valve connections on valve manifold. 3. The valve is suspected; call the Clinical Support Center or your local Beckman representative.
2. Cuvette Wash Station does not move.	1. Verify cable connections. 2. Verify reaction carousel is positioned correctly. 3. Call the Clinical Support Center or your local Beckman representative.
3. Cuvette Wash Station not centered over cuvettes.	1. Perform Cuvette Wash Station alignment, Paragraph 3.7.5.



1 - Sip Valve
2 - Cuvette Wash Vacuum
3 - Sample External Probe Wash
4 - Reagent External Probe Wash
5 - Wash to Cuvette Wash
6 - (Not in Use)
7 - Liquid Trap Dump Valve
8 - Wash Mix Valve
9 - DI Water Mix Valve
10 - DI Water to Cuvette Wash
11 - Degasser Valve (Syringe Pump Valve)

Figure 3-47. Wash Mix Valves



1 - Cuvette Wash Vacuum Valve Line
2 - Cuvette Wash Vacuum Valve Line
3 - Cuvette Wash Vacuum Valve Line
4 - Cuvette Wash Vacuum Valve Line
5 - Cuvette Wash Vacuum Valve Line
6 - Cuvette Wash Vacuum Valve Line
7 - DI Water to Cuvette Wash Valve Line
8 - DI Water to Cuvette Wash Valve Line
9 - Wash to Cuvette Wash Valve Line
10 - Wash to Cuvette Wash Valve Line

Figure 3-48. Cuvette Wash Station Valve Lines

3.8.3 CX4 PNEUMATIC SYSTEM

3.8.3.1 Compressor/Vacuum Pump Test

1. Test Summary. The Compressor/Vacuum Pump Test performs a check on the air pressure and the vacuum levels and allows the operator to turn ON and OFF the compressor/vacuum pump.
2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.
   (e) Cursor and **SELECT** 2. Pneumatic System, or type 2, **ENTER**.

(f) Cursor and **SELECT** 1. Compressor/Vacuum Pump Test, or type 1, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Compressor/Vacuum Pump Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Air pressure, vacuum level out of range.	1. Check air or vacuum lines for leaks or loose fittings. 2. Call the Clinical Support Center or your local Beckman representative.
2. Compressor/vacuum pump does not turn ON or OFF.	1. Check power source. 2. Call the Clinical Support Center or your local Beckman representative.

3.8.3.2 Probe Air Strip Test

1. Test Summary. The Probe Air Strip Test checks the operation of the sample and reagent probe air strip valve. The operator is requested to turn the valve ON and verify the operation by listening for a vacuum sound.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

   (e) Cursor and **SELECT** 2. Pneumatic System, or type 2, **ENTER**.

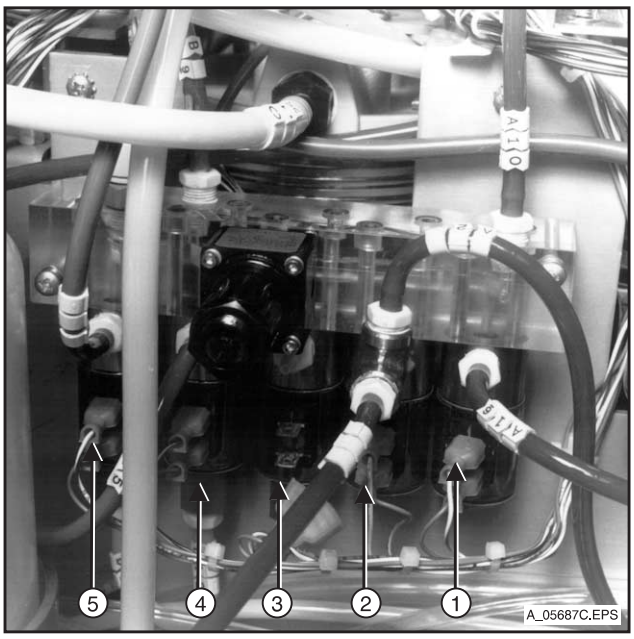
   (f) Cursor and **SELECT** 2. Probe Air Strip Test, or type 2, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Probe Air Strip Test. If the test fails again, continue to the next corrective action step.

   (a) Check valve power connection on air valve manifold.

   (b) Check for air leaks or loose fittings.

   (c) The valve is suspected, call the Clinical Support Center or your local Beckman representative.



1 - Sample Probe Air Strip Valve
2 - Reagent Probe Air Strip Valve
3 - (Not in Use)
4 - Low Air Pressure to Wash Bottle 1
5 - Low Air Pressure to Wash Bottle 2

Figure 3-49. Sample/Reagent Probe Air Strip Valve

3.8.3.3 Scrub Bubble Test

1. Test Summary. The Scrub Bubble Test verifies the operation of the reagent bubbler valve and the internal wash valves. In addition, this test can check for occlusion of the reagent and sample probes. The operator turns on the internal wash valve and visually verifies a stream of water coming from the probe selected. A stream of water that is not straight down indicates a partial occlusion or a bent probe.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

   (e) Cursor and **SELECT** 2. Pneumatic System, or type 2, **ENTER**.

(f) Cursor and **SELECT** 3. Scrub Bubble Test, or type 3, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Scrub Bubble Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. No water stream flowing from either probe.	1. Verify adequate DI water pressure. 2. Perform Probe maintenance, Section 9, in the Operating Instructions manual. 3. Call the Clinical Support Center or your local Beckman representative.
2. Water stream flowing but is not straight down.	1. Perform Probe maintenance, Section 9, in the Operating Instructions manual.

3.8.3.4 Autoloader Test

1. Test Summary. The Autoloader Test confirms autoloader operation and alignment by allowing the operator to raise, rotate and lower the autoloader on command.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

   (e) Cursor and **SELECT** 2. Pneumatic System, or type 2, **ENTER**.

   (f) Cursor and **SELECT** 4. Autoloader Test, or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Autoloader Test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Autoloader raises but does not rotate.	1. Perform Autoloader alignment, Paragraph 3.5.5.2. 2. Call the Clinical Support Center or your local Beckman representative.
2. Autoloader does not raise.	1. Run Compressor/Vacuum Pump Test, Paragraph 3.8.3.1. 2. Verify sample wheel HOMES correctly.
3. Autoloader does not lower.	1. Perform Autoloader alignment, Paragraph 3.5.5.2. 2. Call the Clinical Support Center or your local Beckman representative.

3.8.4 CX4 WASTE COLLECTION SYSTEM

3.8.4.1 Float Switches Level Test

1. Test Summary. The Float Switches Level Test reports the Vacuum Liquid Trap level and the Waste Container fluid level as the sensors report them. The operator compares the actual fluid levels to the test report to determine proper float switch operation.

2. Materials Required. None.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

   (e) Cursor and **SELECT** 3. Waste Collection System, or type 3, **ENTER**.

   (f) Cursor and **SELECT** 1. Float Switches Level Test, or type 1, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Float Switches Level Test. If the test fails again, continue to the next corrective action step.

NOTE

The vacuum liquid trap contains contaminated fluid. Perform decontamination procedure prior to handling open containers. Refer to Paragraph 3.8.5.

(a) Verify sensor connections on Hydropneumatic Interface board.

(b) Verify valve power connectors.

(c) The sensor or Hydropneumatic Interface board is suspected, call the Clinical Support Center or your local Beckman representative.

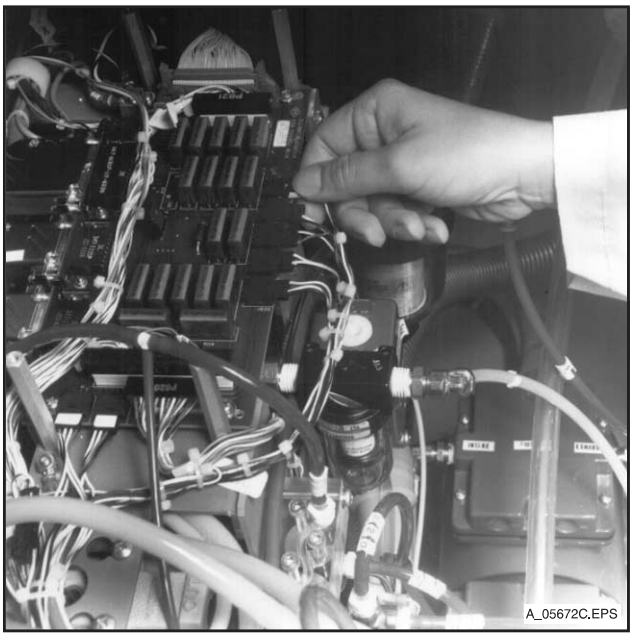


Figure 3-50. Hydropneumatic Interface Board

3.8.4.2 Sump Pump Test

1. Test Summary. The Sump Pump Test verifies the operation of the drain pump. The operator turns the drain pump ON and verifies operation by seeing that the waste container empties.

2. Materials Required. Some fluid is required to be in the vacuum liquid trap in order to confirm sump pump operation. If the vacuum liquid trap contains no fluid, perform the Cuvette Wash test (Paragraph 3.8.2.5) to place fluid in it.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

   (e) Cursor and **SELECT** 3. Waste Collection System, or type 3, **ENTER**.

   (f) Cursor and **SELECT** 2. Sump Pump Test, or type 2, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Sump Pump Test. If the test fails again, continue to the next corrective action step.

NOTE

The sump pump contains contaminated fluid. Perform decontamination procedure prior to handling open containers. Refer to Paragraph 3.8.5.

(a) Verify power connector on sump (drain) pump.

(b) The sump pump is suspected, call the Clinical Support Center or your local Beckman representative.

3.8.4.3 Vacuum Liquid Trap Test

CAUTION

Vacuum Liquid Trap Test should not be run due to the possibility of an overflow of contaminated fluid.

1. Test Summary. The Vacuum Liquid Trap Test turns on the Vacuum Trap Dump Valve to drain the Vacuum Liquid Trap. Operation of the Vacuum Trap Dump Valve is confirmed when the Vacuum Liquid Trap is emptied.

2. Materials Required. Some fluid must be in the vacuum liquid trap for confirmation of vacuum trap dump valve operation. If no fluid exists in the vacuum liquid trap, perform Cuvette Wash test (Paragraph 3.8.2.5) to place fluid in it.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

(c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(d) Cursor and **SELECT** 8. Hydropneumatic System, or type 8, **ENTER**.

(e) Cursor and **SELECT** 3. Waste Collection System, or type 3, **ENTER**.

(f) Cursor and **SELECT** 3. Vacuum Liquid Trap Test, or type 3, **ENTER**.

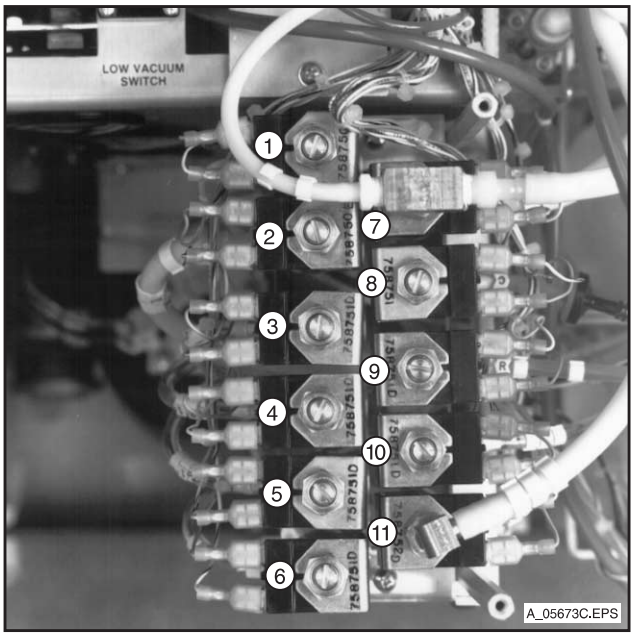
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Vacuum Liquid Trap Test. If the test fails again, continue to the next corrective action step.

NOTE

The vacuum liquid trap contains contaminated fluid. Perform decontamination procedure prior to handling open containers. Refer to Paragraph 3.8.5.

(a) Verify vacuum trap drain valve connection.

(b) The vacuum trap dump valve is suspected, call the Clinical Support Center or your local Beckman representative.



1 - Sip Valve
2 - Cuvette Wash Vacuum
3 - Sample External Probe Wash
4 - Reagent External Probe Wash
5 - Wash to Cuvette Wash
6 - (Not in use)
7 - Liquid Trap Dump Valve
8 - Wash Mix Valve
9 - DI Water Mix Valve
10 - DI Water to Cuvette Wash
11 - Degasser Valve (Syringe Pump Valve)

Figure 3-51. Wash Mix Valves

3.8.5 AUTOMATED HYDROPNEUMATIC DECONTAMINATION

This feature provides step-by-step instructions via the software for the operator to decontaminate the system. The decontamination procedure can be used to minimize microbial contamination in the hydropneumatic system of the SYNCHRON CX4/CX5/CX7 DELTA, or CX4CE/CX5CE/CX7. Frequency of use should be determined in the individual laboratory or when directed by a Beckman Representative.

Acting upon software prompts the operator will be required to change “system” containers with “spare” containers. System containers are those resident on the system. Spare containers are those that come with the decontamination kit. During the course of this procedure the operator will be asked to clean and or rinse certain containers. “Clean” is defined as a physical scrubbing with 70% alcohol. “Rinse” means to wash with DI water.

NOTE

Perform each step as it is highlighted on the screen. Any windows that appear should be responded to immediately. When each step is complete press the **ENTER** key to move to the next step. Certain steps require timing delays after pressing a key. Do not repeat the keystroke as this may cause steps to be skipped. This will lead to the process being aborted. The complete process must then be restarted.

If the decontamination procedure is terminated by the system due to a hardware problem, the operator must step through the Hydropneumatic Decontamination Exit procedure which will be displayed on screen.

If decontamination is terminated by rebooting the system and the complete decontamination procedure cannot be repeated, all system containers should be replaced on the system and three autoprimes should be performed to flush the system.

To prevent reagent contamination any amylase or alcohol reagent cartridges present on the system should be removed from the system, capped, and placed in a refrigerator while the system is being decontaminated. After the procedure is complete these cartridges may be reloaded.

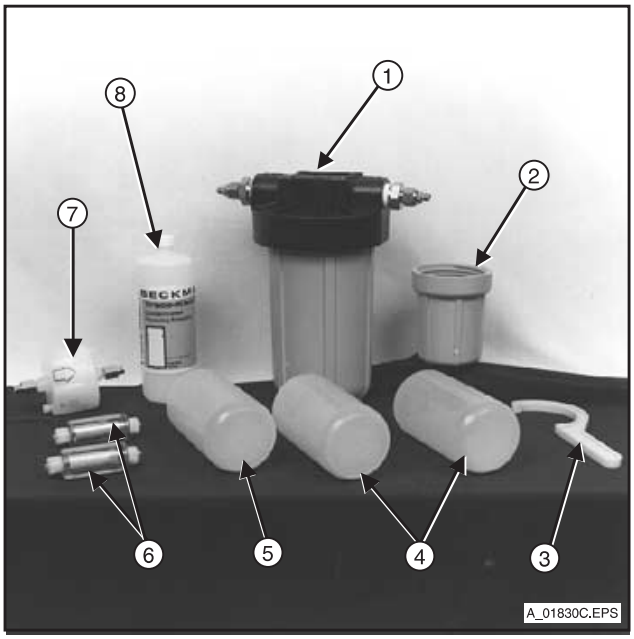
In addition to the decontamination kit and consumables listed here, this procedure requires approximately 6 L of 10% Trace-Klean, 6L of 70% isopropanol, a crescent wrench, and a pair of pliers. It is recommended that a drip tray be placed under the fluid reservoir when in use to guard against small spills or leaks. Free access to the back of the instrument is required to perform this procedure.

Instructions for decontaminating a CX5 (with ISE module) are found in Paragraph 3.8.5.1. Instructions for decontaminating a CX4 system instrumentation (CX7 and CX4) are found in Paragraph 3.8.5.2.

Instructions for decontaminating the CX3 instrumentation of a CX7 are found in Operating Instructions Manual, Paragraph 9.8.3.

CAUTION

Proper protective clothing (such as lab coat, gloves, and eye shields) must be used when performing this procedure.



Decontamination Kit:
1 - Decontamination Fluid Reservoir (1)
2 - Spare DI Water Reservoir (1)
3 - DI Water Reservoir Removal Tool
4 - Spare Dilute Wash Bottles (2)
5 - Spare Probe Rinse Bottle (1)

Consumables:
6 - Degasser Assembly (2)
7 - Prefilter Assembly (1)
8 - Trace-Klean Concentrate (1)

Figure 3-52. Decontamination Kit and Consumables

3.8.5.1 Decontaminate CX5 System Instrumentation

To enter the decontamination function from the DIAGNOSTICS/ALIGNMENT Screen:

(a) Press **F4 CX4 DIAG**.

(b) Press **F2 SETUP OPTIONS** to select operation mode.

(c) Press **SELECT** to set EXTENDED mode.

(d) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(e) Cursor and **SELECT** 8. Hydropneumatic System or type 8, **ENTER**.

(f) Cursor and **SELECT** 4. Hydropneumatic Decontamination or type 4, **ENTER**.

NOTE

It may take users unfamiliar with the system slightly longer than the estimated 1.5 hours to complete the decontamination procedure.

1.

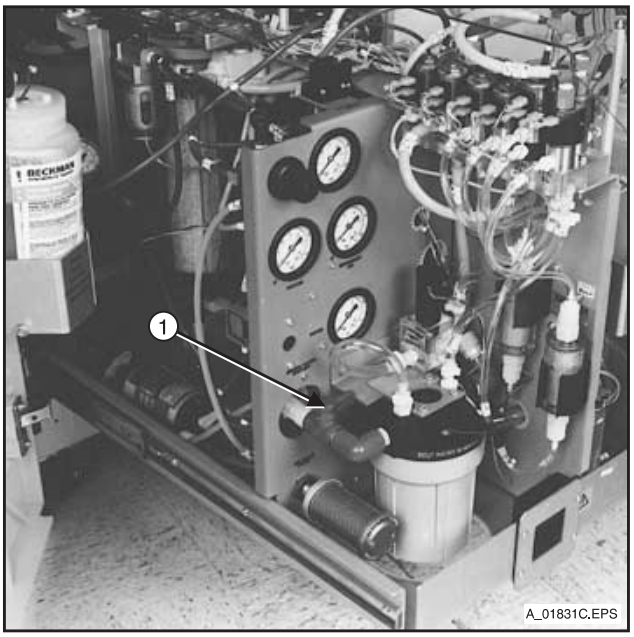
(a) Shut OFF the main water valve on the hydropneumatics

(b) Press the **ENTER** key.

2.

(a) Shut off the house water supply (feeding the back of the system).

(b) Press the **ENTER** key.



1 - Main Water Valve OFF

Figure 3-53. Main Water Valve

3.

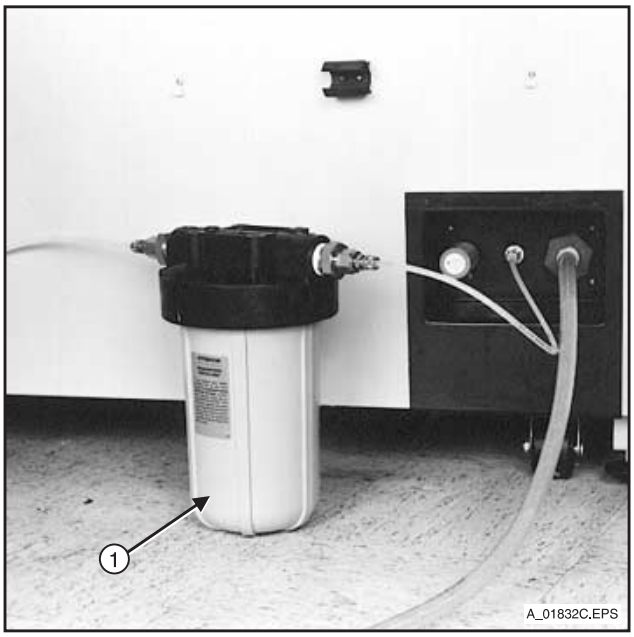
(a) Fill the decontamination fluid reservoir with 10% Trace-Klean.

(b) Fill the spare probe rinse bottle with 10% Trace-Klean.

(c) Press the **ENTER** key.

NOTE

To guard against residual fluid spraying out when disconnecting the decontamination reservoir or prefilter the INLET port must be disconnected before the outlet line.



1 - Decontamination Fluid Reservoir

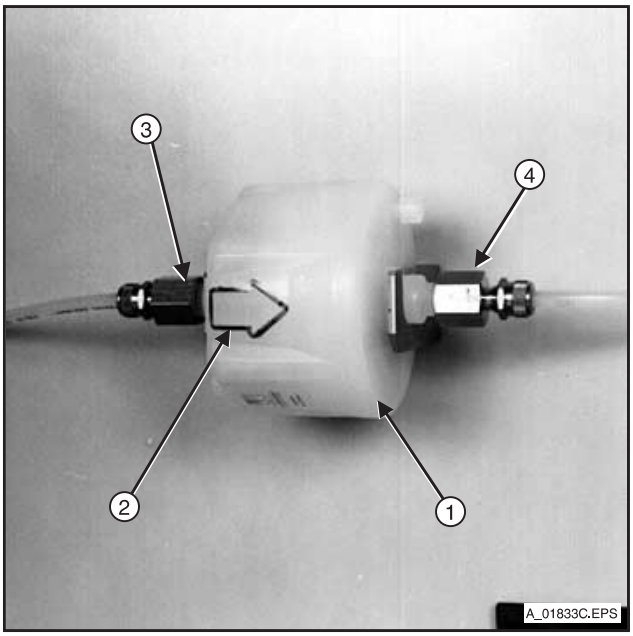
Figure 3-54. Decontamination Fluid Reservoir

4. Remove the prefilter assembly.

(a) Carefully remove the prefilter from its holder.

(b) Disconnect the inlet tubing from the prefilter. The tail of the direction-of-flow arrow is on the inlet side of the prefilter.

(c) Disconnect the outlet tubing from the prefilter. The direction-of-flow arrow points to the outlet end of the prefilter.

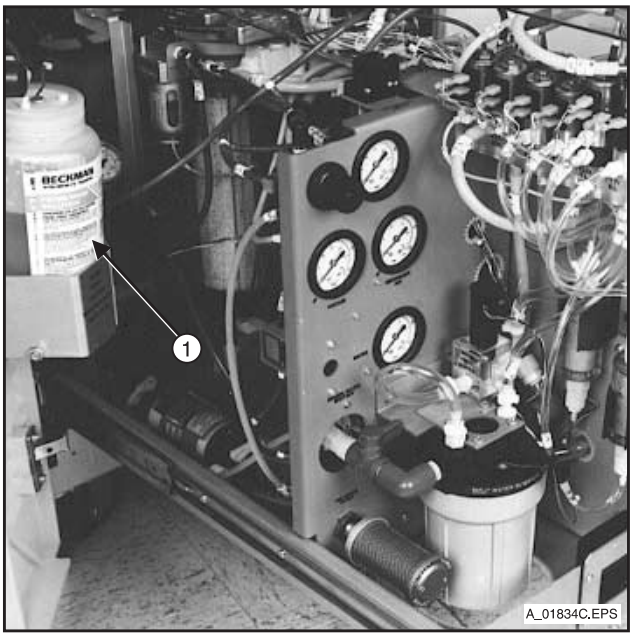


1 - Inlet Prefilter
2 - Direction-of-Flow Arrow
3 - Inlet Line (from Water Supply)
4 - Outlet Line (to instrument)

Figure 3-55. Prefilter

(d) Open the left panel door and remove the system probe rinse bottle.

(e) Press the **ENTER** key.



1 - Probe Rinse Bottle

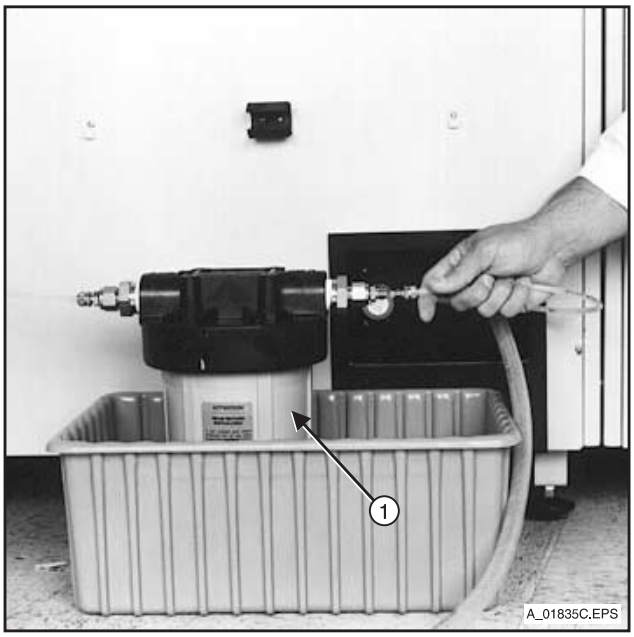
Figure 3-56. Hydropneumatics Assembly

5.

(a) Install the decontamination fluid reservoir:

i. Connect the tubing from the house water valve to the port marked IN on the decontamination fluid reservoir.

ii. Connect the tubing from the instrument to the port marker OUT on the decontamination fluid reservoir.

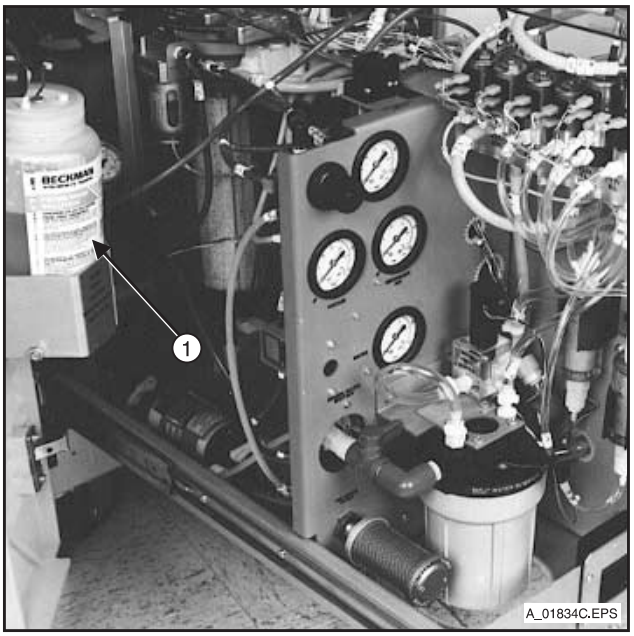


1 - Decontamination Fluid Reservoir

Figure 3-57. Decontamination Fluid Reservoir

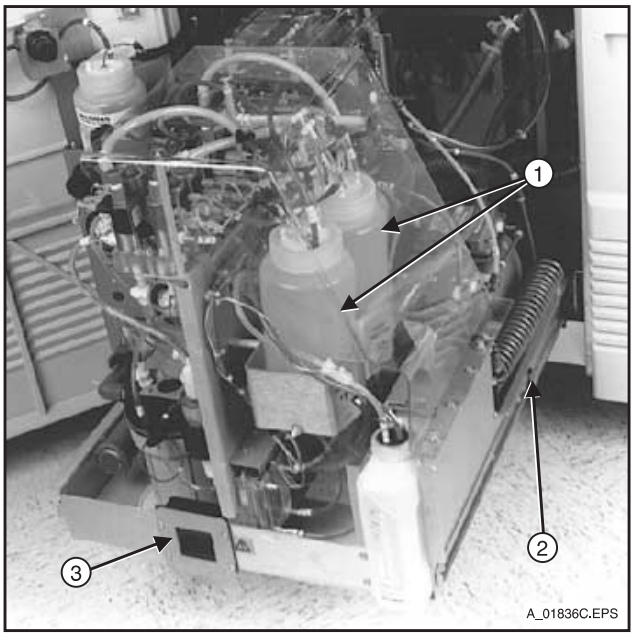
(b) Clean the probe rinse bottle cap with 70% alcohol and rinse with DI water. Install the spare probe rinse bottle previously filled with 10% Trace-Klean.

(c) Press the **ENTER** key.



1 - Probe Rinse Bottle

Figure 3-58. Hydropneumatics Assembly



1 - Dilute Wash Bottles 1 and 2
2 - Locking Tab (Front)
3 - Locking Tabs (One on each Side)

Figure 3-59. Hydropneumatics Assembly

6.

(a) Remove system dilute wash bottles 1 and 2.

i. Pull out the hydropneumatic drawer by pulling up on the locking tab at the front of the drawer. With the tab held in the up position slide the drawer out towards the front.

NOTE

The drawer becomes locked in the out position when it is fully extended. To slide back into the system push on the lock tabs located on each side of the slides for the drawer.

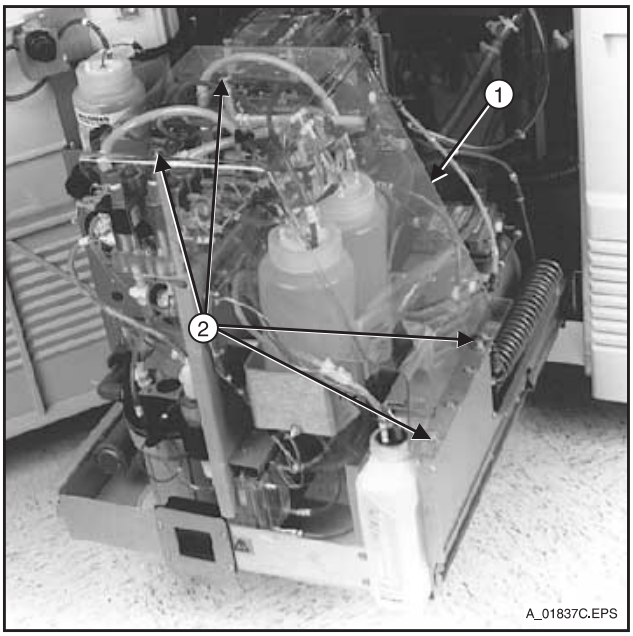
ii. Remove the 4 screws attaching the plastic protective cover to the hydropneumatics. Remove the cover from over the hydropneumatics.

iii. Locate the dilute wash bottles.

iv. Slightly loosen the cap of one of the dilute wash bottles to vent any residual pressure.

v. Completely unscrew the caps of each of the dilute wash bottles and carefully remove the float sensors from each.

vi. Remove each bottle from its holder. Set aside for cleaning.



1 - Hydropneumatics Cover
2 - 4 Attaching Screws

Figure 3-60. Hydropneumatics Assembly

1 - DI Water Reservoir
2 - DI Water Reservoir Removal Tool

Figure 3-61. DI Water Reservoir

(b) Remove the system DI water reservoir from the system.

i. Locate the DI water reservoir.

ii. Being sure to hold the DI water reservoir upright to prevent spillage, unscrew the DI water reservoir clockwise. If the DI water reservoir is stuck, use the DI water reservoir removal tool.

(c) Press the **ENTER** key.

7.

(a) Clean the DI water reservoir cap with 70% alcohol, rinse the cap with DI water, and install the empty *spare* DI water reservoir.

i. Holding upright, install reservoir through hole in bottom of hydropneumatic drawer.

ii. Hand-tighten the reservoir counterclockwise.

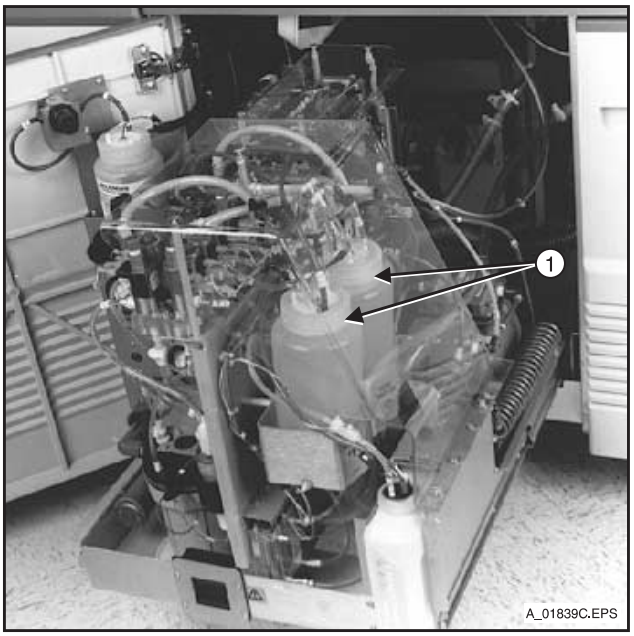
(b) Clean the dilute wash bottle caps with 70% alcohol, rinse with DI water, and install empty *spare* dilute wash bottles 1 and 2.

i. Carefully insert the float switch assemblies into each bottle.

ii. Seat each cap on the respective bottle and hand-tighten.

iii. Insert bottles into their holders.

(c) Press the **ENTER** key



1 - Dilute Wash Bottle 1 and 2 Caps

Figure 3-62. Dilute Wash Bottles

8.

(a) Remove, empty, and reinstall the ISE wash bottle after cleaning the wash bottle cap with 70% alcohol and rinsing with DI water.

(b) Press the **ENTER** key.

1 - ISE Wash Bottle

Figure 3-63. ISE Reagents

9.

a. Turn ON the main water valve on the hydropneumatics.

b. Press the **ENTER** key.

10.

(a) Turn on the house water valve.

(b) Press the **ENTER** key. There is approximately a 15-minute delay at this step. During this time watch for leaks and perform the cleaning described in the following message which is now displayed on the screen:

"While the system is running, empty and clean all SYSTEM containers. Fill the system probe rinse bottle with 70% alcohol."

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

Check the connections and press the PREV SCREEN key to continue. If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

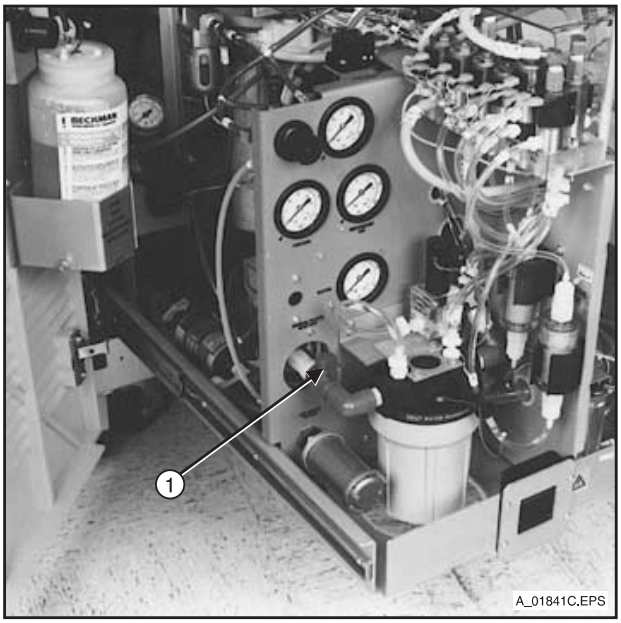
Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to return to the Diagnostics menu and contact the Clinical Support Center or your local Beckman Representative.

If the ISE wash bottle is NOT empty, the following message will appear:

"The ISE wash bottle is not empty. Remove, empty, and re-install ISE wash bottle.

Press <PREV SCREEN> to exit."



1 - Main Water Valve ON

Figure 3-64. Main Water Valve

11.

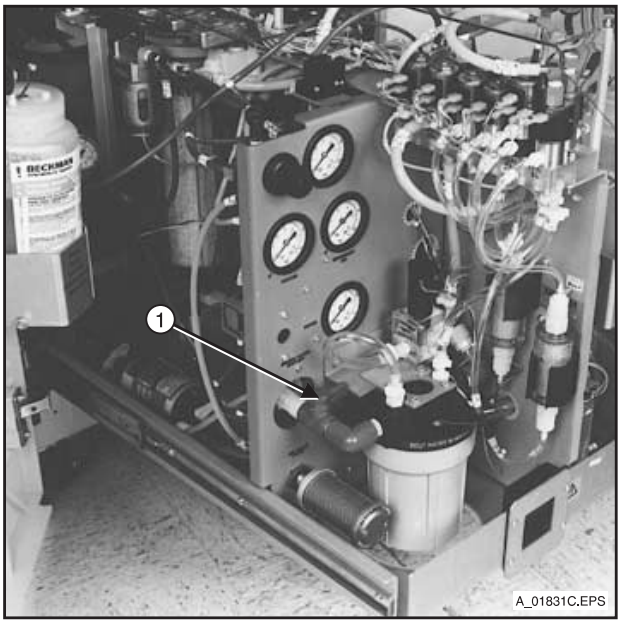
(a) Shut OFF the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

12.

(a) Shut OFF the house water valve.

(b) Press the **ENTER** key.



1 - Main Water Valve OFF

Figure 3-65. Main Water Valve

NOTE

Loosen connectors slowly to vent any residual water pressure that may cause fluid sprays. Use caution when lifting decontamination reservoir. It is full and may spill.

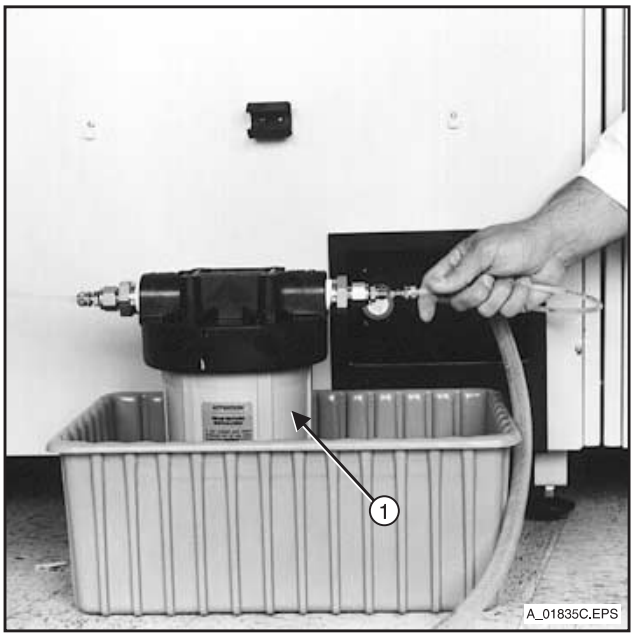
13. Remove the decontamination fluid reservoir.

(a) Empty and rinse with DI water.

(b) Fill with 70% isopropanol.

(c) Reinstall.

(d) Press the **ENTER** key.



1 - Decontamination Fluid Reservoir

Figure 3-66. Decontamination Fluid Reservoir

14.

(a) Remove spare dilute wash bottles 1 and 2.

(b) Remove spare DI water reservoir.

(c) Remove spare probe rinse bottle.

(d) Press the **ENTER** key.

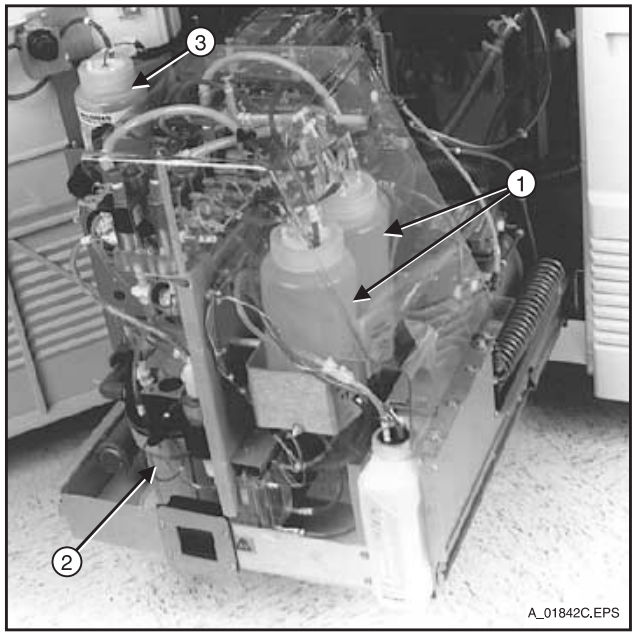
15.

(a) Install empty and cleaned system dilute wash bottles 1 and 2.

(b) Install empty and cleaned system DI water reservoir.

(c) Install clean system probe rinse bottle previously filled with 70% alcohol.

(d) Press the **ENTER** key.



1 - Dilute Wash Bottles 1 and 2
2 - DI Water Reservoir
3 - Probe Rinse Bottle

Figure 3-67. Hydropneumatics Assembly

16.

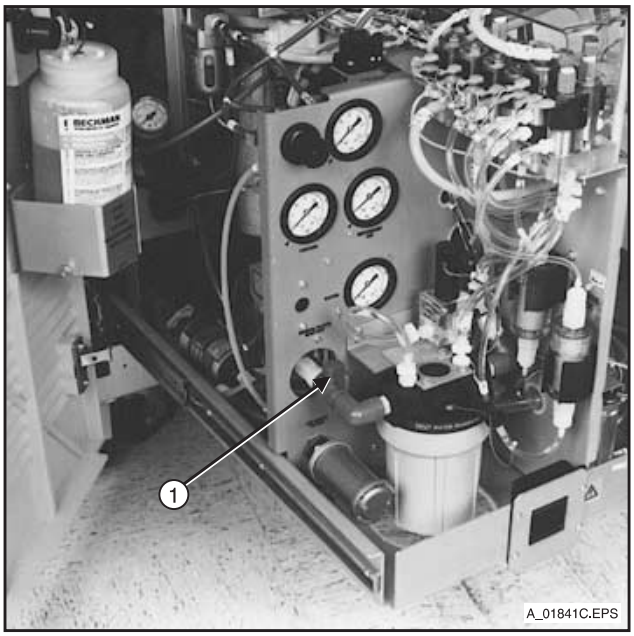
(a) Turn ON the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

17.

(a) Turn ON the house water.

(b) Press the **ENTER** key.



1 - Main Water Valve ON

Figure 3-68. Main Water Valve

18. Remove, empty, and clean the ISE wash bottle.

(a) Fill with 70% isopropanol.

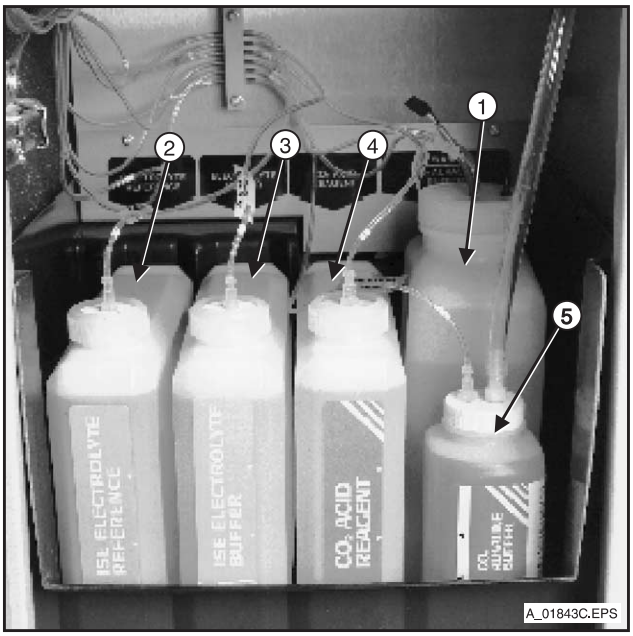
(b) Reinstall on the system.

(c) Press the **ENTER** key.

19.

(a) Remove the electrolyte reference (EREF), electrolyte buffer (EBUF), and CO_2 ACID straws from their reagent containers. DO NOT remove the CO_2 ALKALINE BUFFER straws.

(b) Press the **ENTER** key.



1 - ISE Wash Bottle
2 - EREF Reagent
3 - EBUF Reagent
4 - CO_2 ACID Reagent
5 - CO_2 BUFFER Reagent

Figure 3-69. ISE Reagents

20.

(a) Place EREF, EBUF and CO_2 ACID straws in a 500-mL beaker of 70% isopropanol.

(b) Press the **ENTER** key. (There is an approximate 15-minute delay at this step).

The following message will be displayed:

"While the system is running, empty and rinse all spare containers. Fill the spare probe rinse bottle with DI water.

Press <PREV SCREEN> to exit"

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

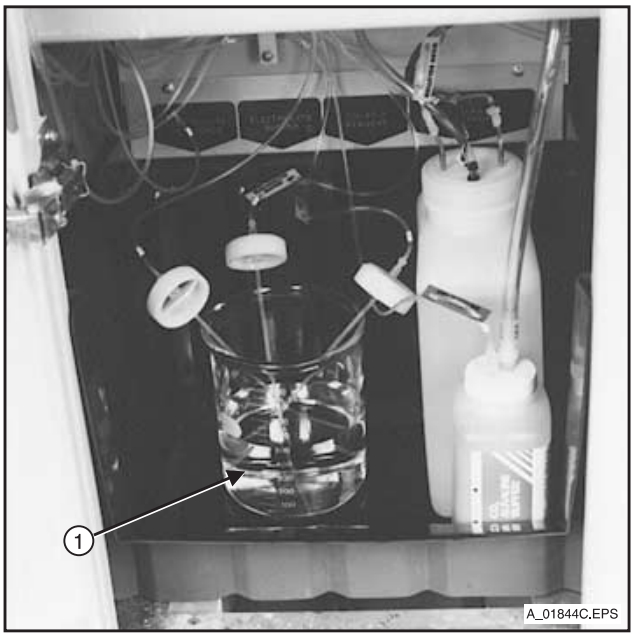
Check the connections and press the PREV SCREEN key to continue.

If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to initiate a return to the Diagnostics menu. Contact the Clinical Support Center or your local Beckman Representative.



1 - 500-mL Beaker of 70% Alcohol

Figure 3-70. Flushing Straws with 70% Isopropanol

21.

(c) Remove, empty, and reinstall the ISE wash bottle.

(d) Remove all ISE reagent straws from the beaker of alcohol.

(e) Press the **ENTER** key.

22.

(a) Wipe the exteriors of the straws with a lintless tissue. DO NOT place them in the reagent bottles.

(b) Press the **ENTER** key.

1 - ISE Wash Bottle

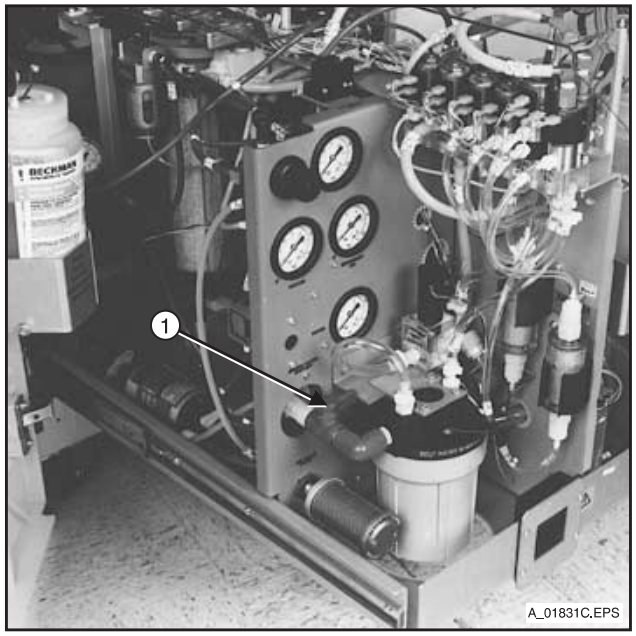
Figure 3-71. ISE Wash Bottle and Straws

23.

(a) Shut OFF the main water valve on the hydropneumatics.

(b) Shut OFF the house water valve

(c) Press the **ENTER** key.



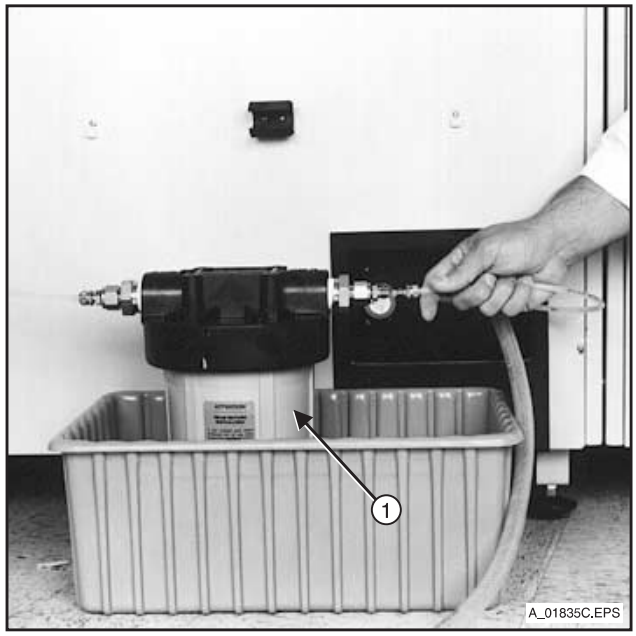
1 - Main Water Valve OFF

Figure 3-72. Main Water Valve

24.

(a) Remove the decontamination fluid reservoir.

(b) Press the **ENTER** key.



1 - Decontamination Fluid Reservoir

Figure 3-73. Decontamination Fluid Reservoir

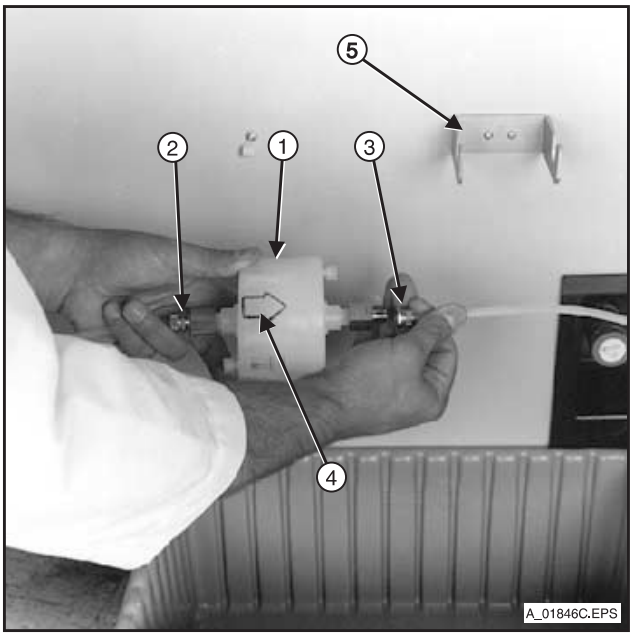
25. Install the new prefilter assembly.

(a) Connect the new prefilter (via the new inlet line attached to the new prefilter) to the house water valve. The inlet side is at the tail of the direction-of-flow arrow.

(b) Connect the outlet tubing of the new prefilter to the instrument. The outlet tubing is at the head of the direction-of-flow arrow.

(c) Place filter in bracket.

(d) Press the **ENTER** key.



1 - Inlet Prefilter
2 - Inlet Line (from Water Supply)
3 - Outlet Line (to instrument)
4 - Direction-of-Flow Arrow
5 - Bracket

Figure 3-74. Prefilter

26.

(a) Remove system dilute wash bottles 1 and 2.

(b) Remove system DI water reservoir.

(c) Remove system Probe rinse bottle.

(d) Press the **ENTER** key.

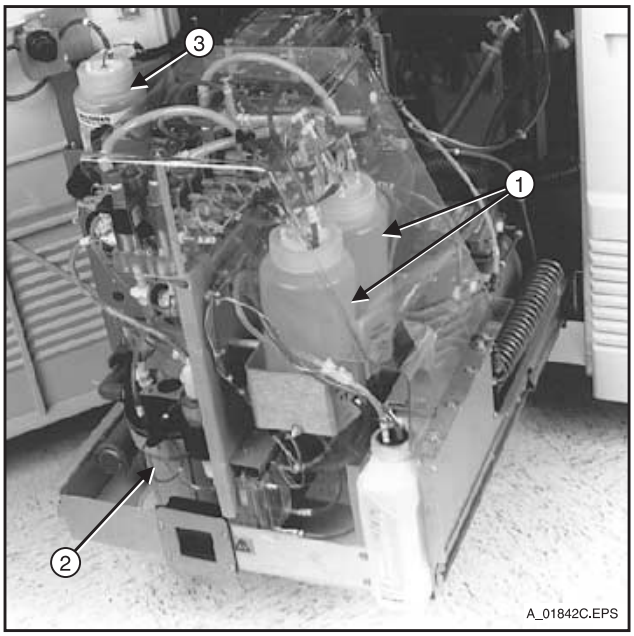
27.

(a) Install empty SPARE dilute wash bottles 1 and 2.

(b) Install spare DI water reservoir.

(c) Install spare probe rinse bottle which was previously filled with DI water.

(d) Press the **ENTER** key.



1 - Dilute Wash Bottles 1 and 2
2 - DI Water Reservoir
3 - Probe Rinse Bottle

Figure 3-75. Hydropneumatics Assembly

28.

(a) Turn ON the main water valve on the hydropneumatics.

(b) Turn ON the house water valve.

(c) Press the **ENTER** key. There is approximately a 15-minute delay. During this time perform the cleaning described by the following note which is displayed on the screen at this time:

"While the system is running, empty and clean all system containers. Fill the system probe rinse bottle with probe rinse solution."

(d) Clean system containers: dilute wash bottles 1 and 2, and DI water reservoir as follows.

i. Partially fill container with Trace-Klean.

ii. Swirl or shake to coat interior surface.

iii. Scrub interior with a brush.

iv. Rinse container 10 times with DI water.

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

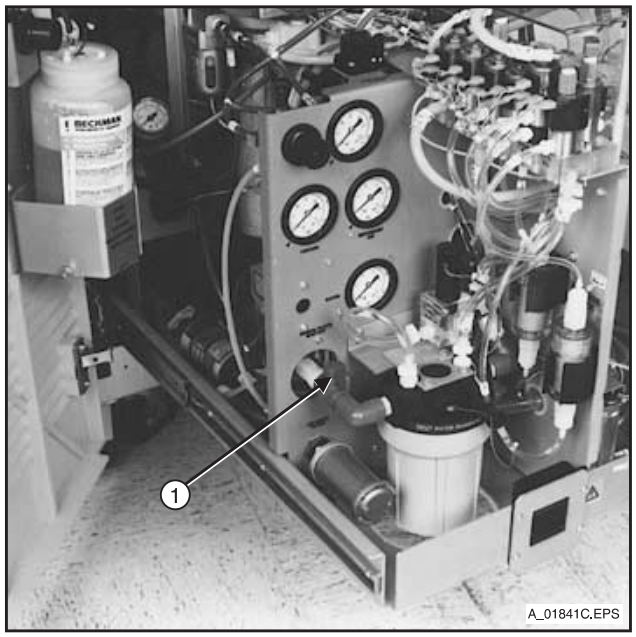
Check the connections and press the PREV SCREEN key to continue.

If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to initiate a return to the Diagnostics menu. Contact the Clinical Support Center or your local Beckman Representative.



1 - Main Water Valve ON

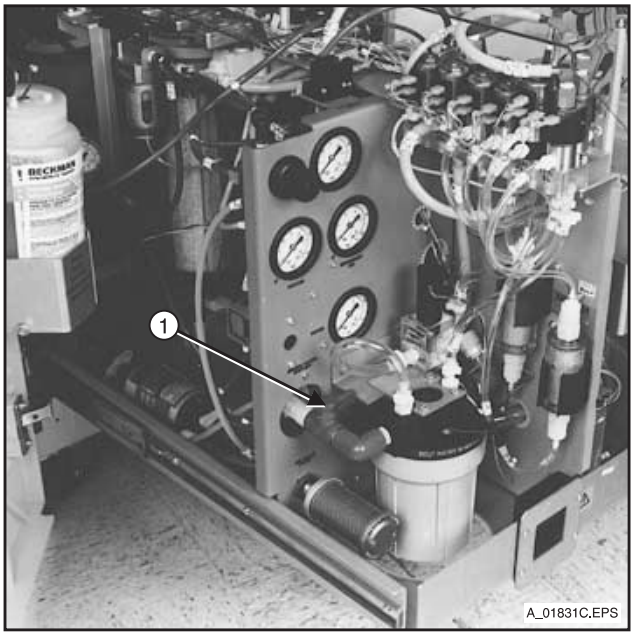
Figure 3-76. Main Water Valve

29.

(a) Shut OFF the main water valve on the hydropneumatics.

(b) Shut OFF the house water valve.

(c) Press the ENTER key.



1 - Main Water Valve OFF

Figure 3-77. Main Water Valve

30. Remove, empty and clean the ISE wash bottle.

(a) Partially fill bottle with Trace-Klean.

(b) Swirl or shake to coat interior surface.

(c) Scrub interior with a brush.

(d) Rinse bottle 10 times with DI water.

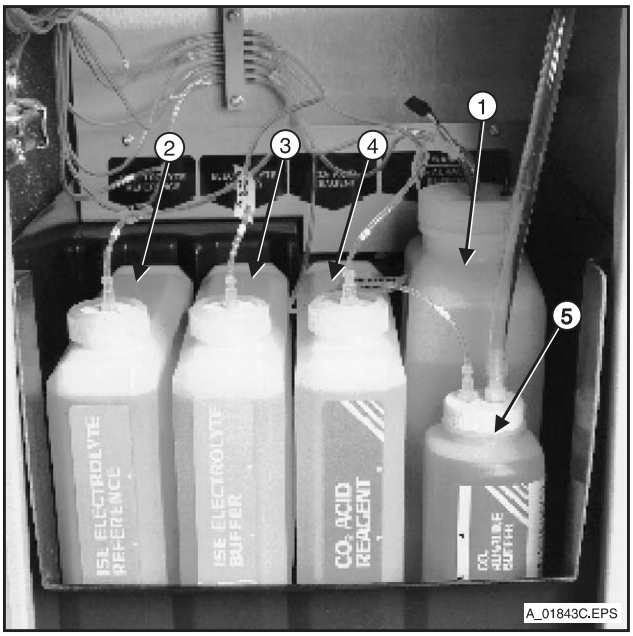
(e) Reinstall the ISE wash bottle on the system.

(f) Press the **ENTER** key.

31.

(a) Place all ISE straws in the appropriate containers as indicated by the colored tabs on the lines.

(b) Press the **ENTER** key.



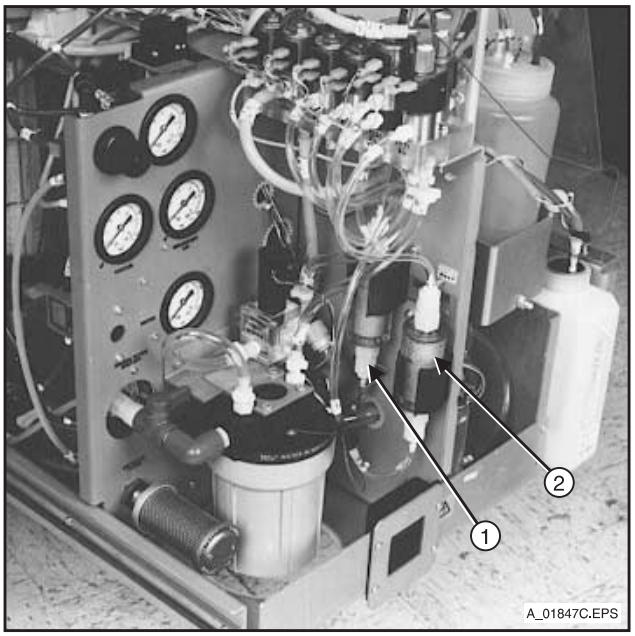
1 - ISE Wash Bottle
2 - EREF Reagent
3 - EBUF Reagent
4 - CO_2 ACID Reagent
5 - CO_2 BUFFER Reagent

Figure 3-78. ISE Reagents

32. Remove the existing degasser assemblies.

    (a) Locate the degassers in the hydropneumatics assembly.

    (b) Carefully remove one degasser (ISE or syringe) from its holder.



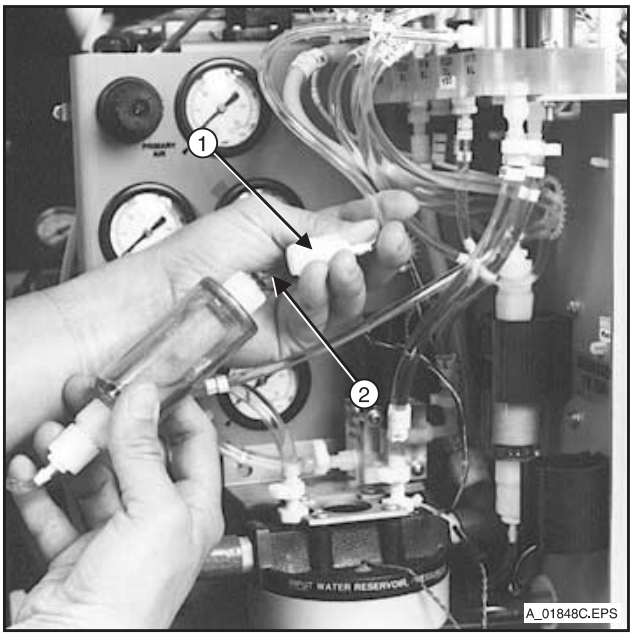
1 - Syringe Degasser Assembly
2 - ISE Degasser Assembly (CX5 Only)

Figure 3-79. Degasser Assembly

    (c) Disconnect the tubing from both ends of the degasser by unscrewing the innermost white plastic nuts.

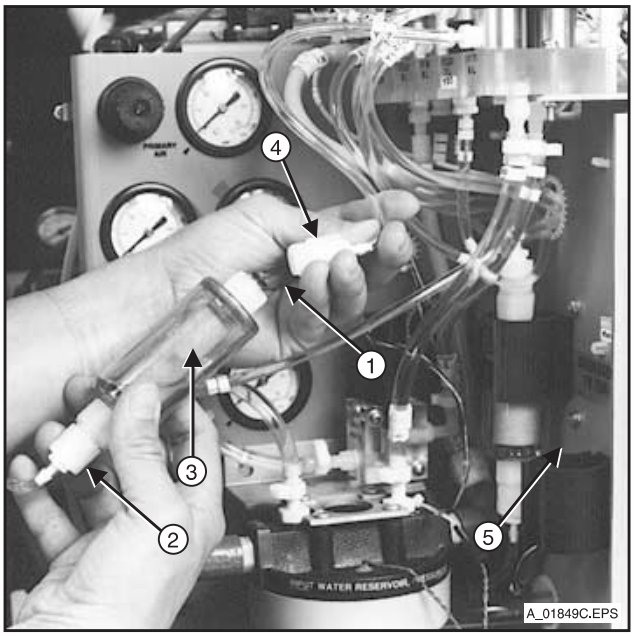
    (d) Remove the O-ring from each end of the degasser and save for later installation.

    (e) Repeat Steps (a) through (d) for the second degasser.



1 - White Plastic Nut (One on Each End)
2 - Black O-ring (One on Each End)

Figure 3-80. Degasser



1 - Black O-ring (One on Each End)
2 - Inlet Line
3 - Direction-of-Flow Arrow
4 - Outlet Line
5 - Degasser Holder

Figure 3-81. Degasser

Install the New Degasser Assemblies:

(f) Install an O-ring on each end of one of the new degassers.

(g) Connect the tubing with the attached check valve to the inlet side of the degasser. The inlet side is at the tail of the direction-of-flow arrow.

(h) For ISE degasser connect the tubing labeled Y7 attached to solenoid 6L to the outlet side of the degasser. For syringe degasser connect tubing labeled R10 attached to solenoid 1L to the outlet side of the degasser. The outlet side of the degasser is at the head of the direction-of-flow arrow.

(i) Install the degasser into its holder.

(j) Repeat Steps (f) through (i) for the second degasser.

(k) Press the **ENTER** key.

33.

(a) Remove spare dilute wash bottles 1 and 2.

(b) Remove the spare DI water reservoir.

(c) Remove the spare probe rinse bottle.

(d) Press the **ENTER** key.

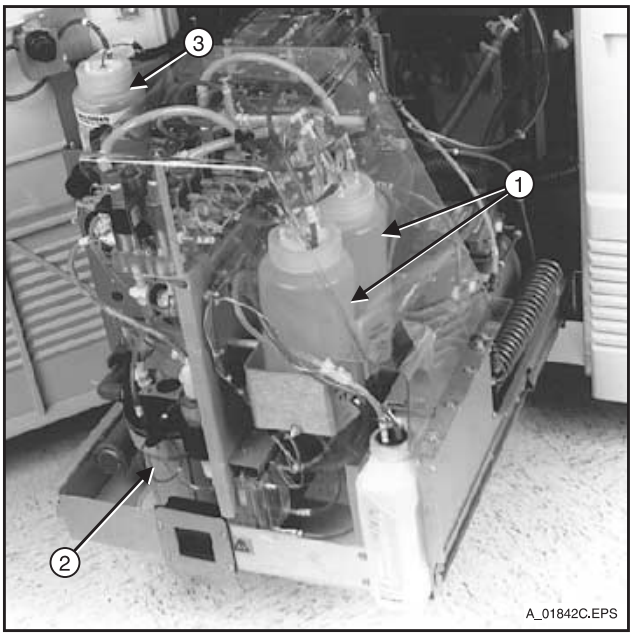
34.

(a) Install empty and cleaned system dilute wash bottles 1 and 2.

(b) Install empty and cleaned DI water reservoir.

(c) Install probe rinse bottle previously filled with dilute probe rinse solution.

(d) Press the **ENTER** key.



1 - Dilute Wash Bottles 1 and 2
2 - DI Water Reservoir
3 - Probe Rinse Bottle

Figure 3-82. Hydropneumatics Assembly

35. Turn ON the main water valve on the hydropneumatics.

36.

(a) Turn ON the house water valve.

(b) Press the **ENTER** key. There is approximately a 15-minute delay at this step. During this time perform the cleaning as described in the following window that is now displayed on the screen:

"While the system is running empty and rinse all spare containers. Store them for next hydropneumatic cleaning."

(c) When the system has completed priming a note will appear:

"The decontamination is complete. Please verify system operation by calibrating all onboard chemistries and running controls.

Press <PREV SCREEN> to exit"

(d) Press the **PREV SCREEN** key to return to the Diagnostics menu.

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

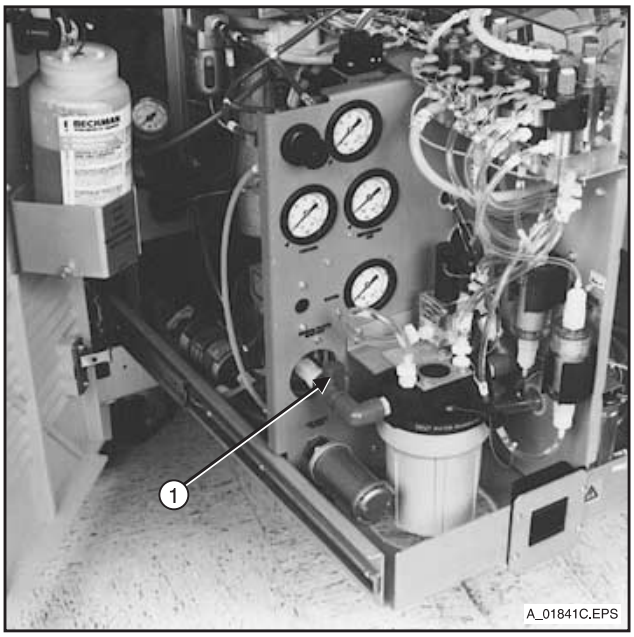
Check the connections and press the PREV SCREEN key to continue.

If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to initiate a return to the Diagnostics menu. Contact the Clinical Support Center or your local Beckman Representative.



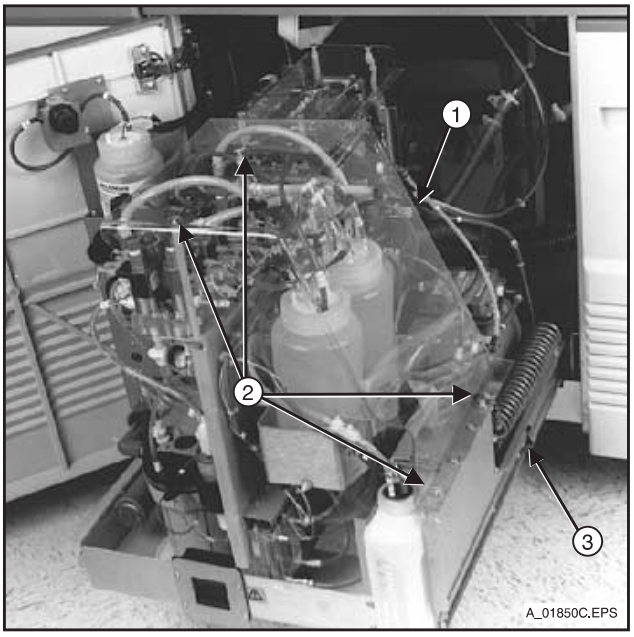
1 - Main Water Valve ON

Figure 3-83. Main Water Valve

37. Reinstall the hydropneumatic cover over the hydropneumatics.

38. Release the locking tabs on each side of the hydropneumatic drawer and slide the drawer back into the system.

39. Check fluid levels, calibrate applicable chemistries, and run controls to verify system operation.



1 - Hydropneumatics Cover
2 - 4 Attaching Screws
3 - Locking Tabs (One on Each Side)

Figure 3-84. Hydropneumatics Assembly

3.8.5.2 Decontaminate CX4 System Instrumentation (CX7 and CX4)

To enter the decontamination function from the DIAGNOSTICS/ALIGNMENT Screen:

(a) Press **F4 CX4 DIAG**.

(b) Press **F2 SETUP OPTIONS** to select operation mode.

(c) Press **SELECT** to set EXTENDED mode.

(d) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

(e) Cursor and **SELECT** 8. Hydropneumatic System or type 8, **ENTER**.

(f) Cursor and **SELECT** 4. Hydropneumatic Decontamination or type 4, **ENTER**.

NOTE

It may take users unfamiliar with the system slightly longer than the estimated 1.5 hours to complete the decontamination procedure.

1.

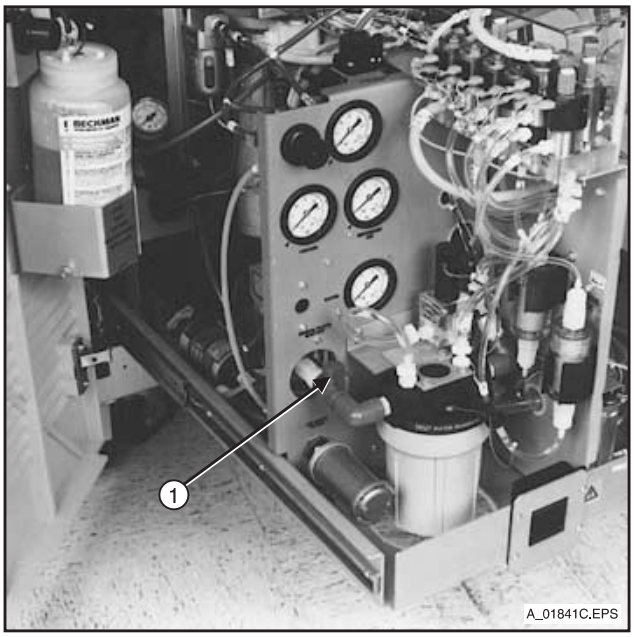
(a) Shut OFF the main water valve on the hydropneumatics

(b) Press the **ENTER** key.

2.

(a) Shut off the house water supply (feeding the back of the system).

(b) Press the **ENTER** key.



1 - Main Water Valve OFF

Figure 3-85. Main Water Valve

3.

(a) Fill the decontamination fluid reservoir with 10% Trace-Klean.

(b) Fill the spare probe rinse bottle with 10% Trace-Klean.

(c) Press the **ENTER** key.

NOTE

To guard against residual fluid spraying out when disconnecting the decontamination reservoir or prefilter the INLET port must be disconnected before the outlet line.

1 - Decontamination Fluid Reservoir

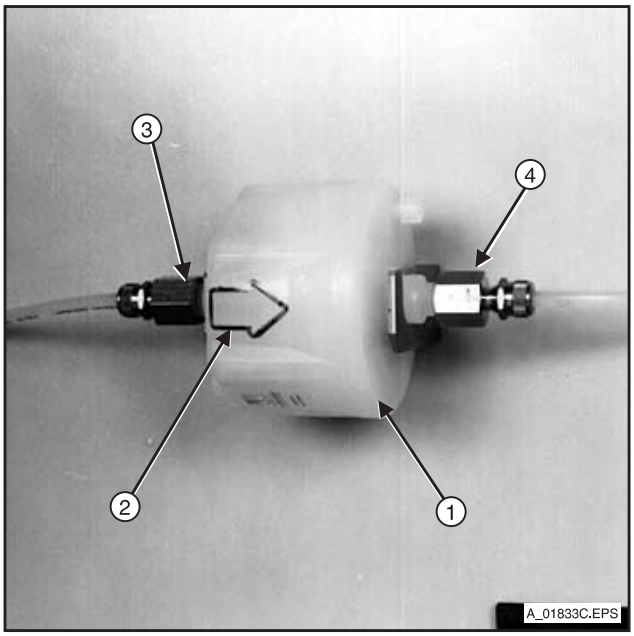
Figure 3-86. Decontamination Fluid Reservoir

4. Remove the prefilter assembly.

   (a) Carefully remove the prefilter from its holder.

   (b) Disconnect the inlet tubing from the prefilter. The tail of the direction-of-flow arrow is on the inlet side of the prefilter.

   (c) Disconnect the outlet tubing from the prefilter. The direction-of-flow arrow points to the outlet end of the prefilter.

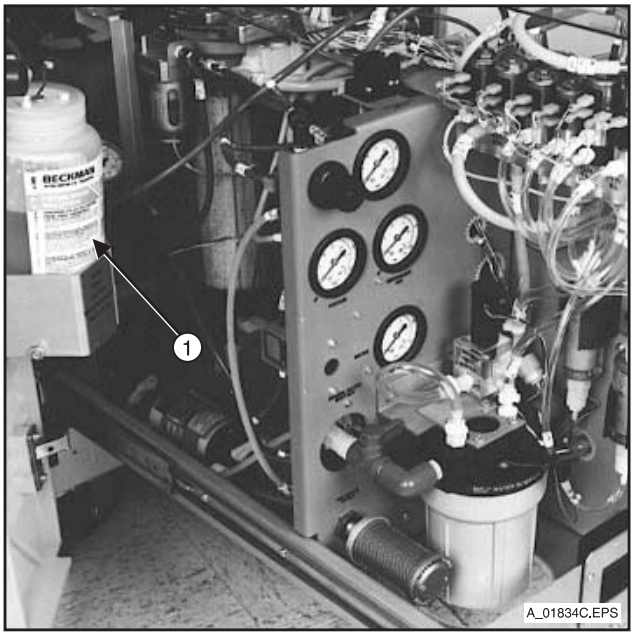


1 - Inlet Prefilter
2 - Direction-of-Flow Arrow
3 - Inlet Line (from Water Supply)
4 - Outlet Line (to instrument)

Figure 3-87. Prefilter

   (d) Open the left panel door and remove the system probe rinse bottle.

   (e) Press the **ENTER** key.



1 - Probe Rinse Bottle

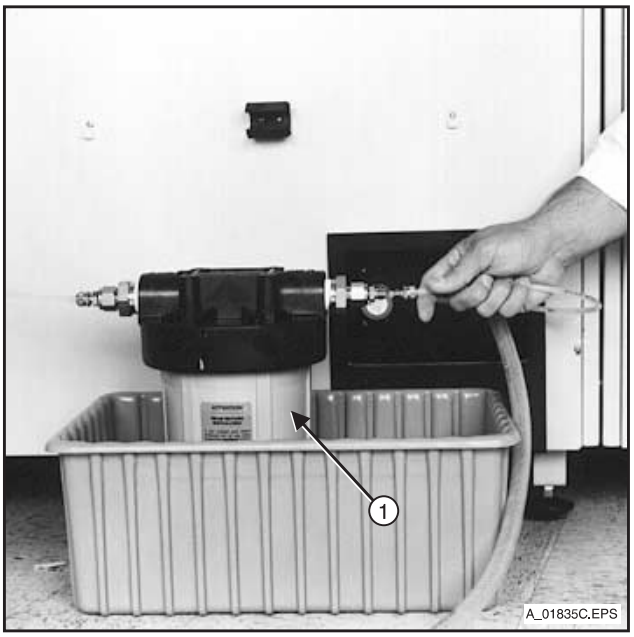
Figure 3-88. Hydropneumatics Assembly

5.

(a) Install the decontamination fluid reservoir:

i. Connect the tubing from the house water valve to the port marked IN on the decontamination fluid reservoir.

ii. Connect the tubing from the instrument to the port marker OUT on the decontamination fluid reservoir.

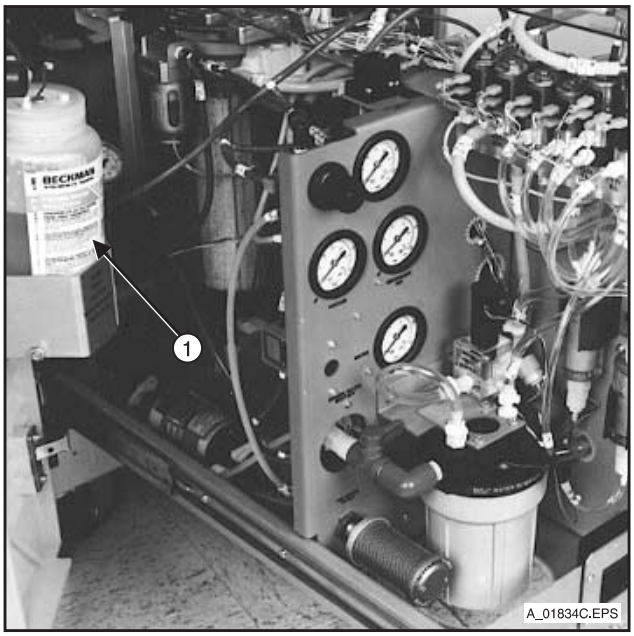


1 - Decontamination Fluid Reservoir

Figure 3-89. Decontamination Fluid Reservoir

(b) Clean the probe rinse bottle cap with 70% alcohol and rinse with DI water. Install the spare probe rinse bottle previously filled with 10% Trace-Klean.

(c) Press the **ENTER** key.



1 - Probe Rinse Bottle

Figure 3-90. Hydropneumatics Assembly

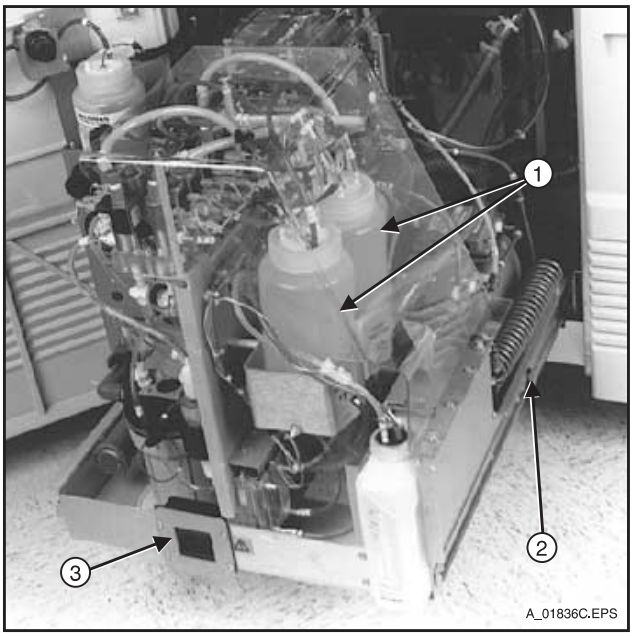
6.

(a) Remove system dilute wash bottles 1 and 2.

i. Pull out the hydropneumatic drawer by pulling up on the locking tab at the front of the drawer. With the tab held in the up position slide the drawer out towards the front.

NOTE

The drawer becomes locked in the out position when it is fully extended. To slide back into the system push on the lock tabs located on each side of the slides for the drawer.



1 - Dilute Wash Bottles 1 and 2
2 - Locking Tab (Front)
3 - Locking Tabs (One on each Side)

Figure 3-91. Hydropneumatics Assembly

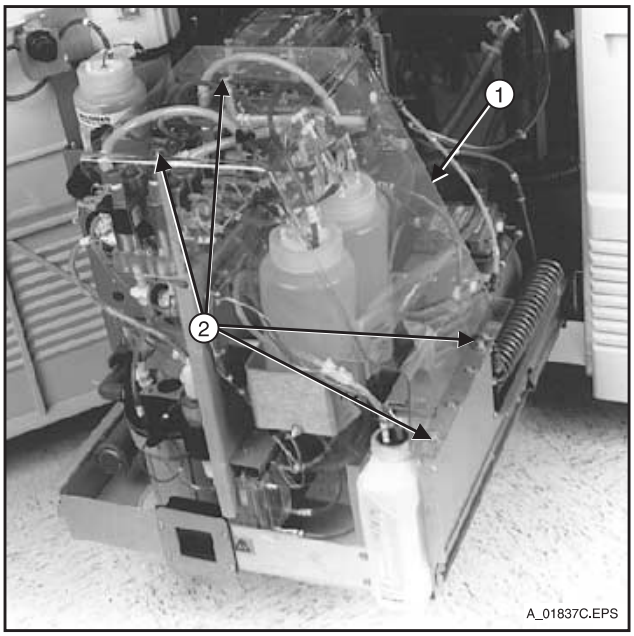
ii. Remove the 4 screws attaching the plastic protective cover to the hydropneumatics. Remove the cover from over the hydropneumatics.

iii. Locate the dilute wash bottles.

iv. Slightly loosen the cap of one of the dilute wash bottles to vent any residual pressure.

v. Completely unscrew the caps of each of the dilute wash bottles and carefully remove the float sensors from each.

vi. Remove each bottle from its holder. Set aside for cleaning



1 - Hydropneumatics Cover
2 - 4 Attaching Screws

Figure 3-92. Hydropneumatics Assembly

(b) Remove the system DI water reservoir from the system.

i. Locate the DI water reservoir.

ii. Being sure to hold the DI water reservoir upright to prevent spillage, unscrew the DI water reservoir clockwise. If the DI water reservoir is stuck, use the DI water reservoir removal tool.

(c) Press the **ENTER** key.

7. Clean the dilute wash bottle caps with 70% alcohol, rinse with DI water, and install the empty *spare* dilute wash bottles 1 and 2.

(a) Carefully insert the float switch assemblies into each bottle.

(b) Seat each cap on the respective bottle and hand-tighten.

1 - 1 - DI Water Reservoir
2 - 2 - DI Water Reservoir Removal Tool

Figure 3-93. DI Water Reservoir

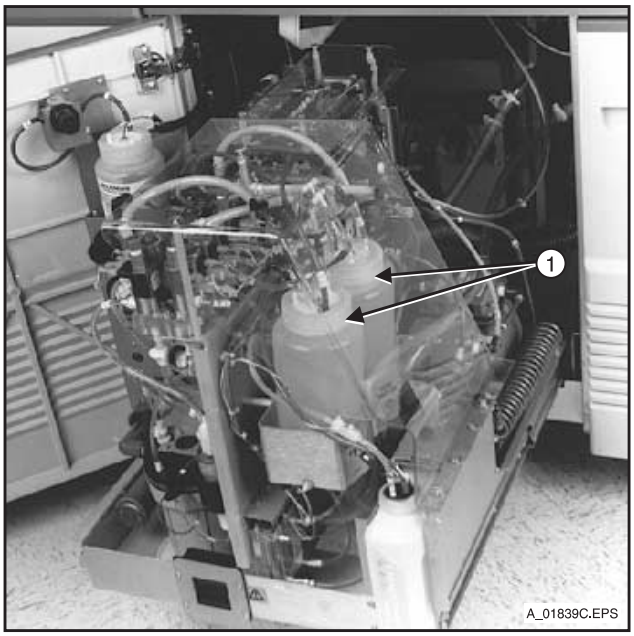
(c) Insert bottles into their holders.

(d) Press the **ENTER** key

8. Install the empty *spare* DI water reservoir:

(a) Holding upright install reservoir through hole in bottom of hydropneumatic drawer.

(b) Hand-tighten the reservoir counterclockwise



1 - Dilute Wash Bottle 1 and 2 Caps

Figure 3-94. Dilute Wash Bottles

9.

(a) Turn ON the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

10.

(a) Turn on the house water valve.

(b) Press the **ENTER** key. There is approximately a 15-minute delay at this step. During this time watch for leaks and perform the cleaning described in the following message which is now displayed on the screen:

"While the system is running, empty and clean all system containers. Fill the system probe rinse bottle with 70% alcohol."

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

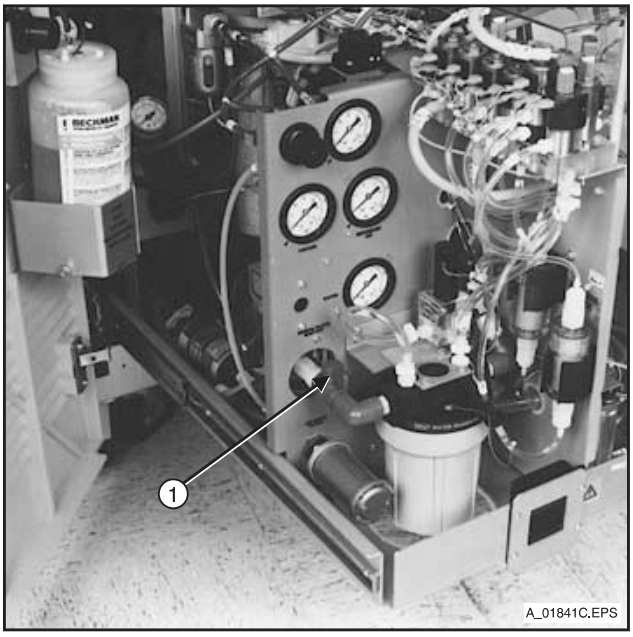
Check the connections and press the PREV SCREEN key to continue.

If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to return to the Diagnostics menu. Contact the Clinical Support Center or your local Beckman Representative



1 - Main Water Valve ON

Figure 3-95. Main Water Valve

11.

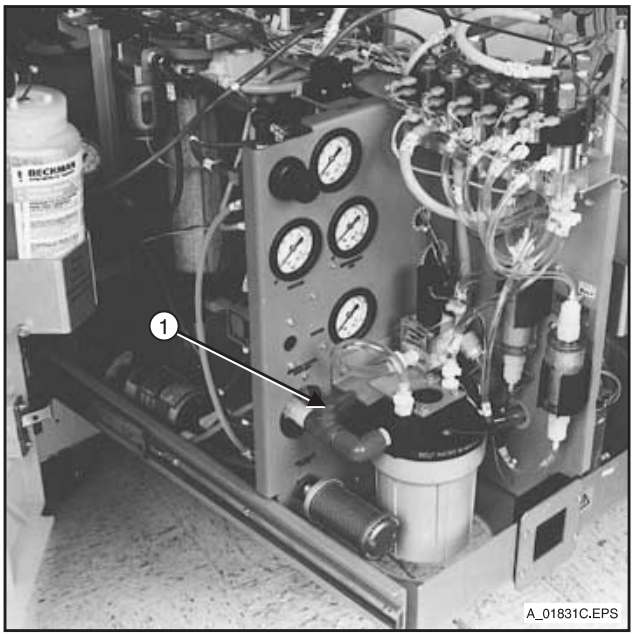
(a) Shut OFF the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

12.

(a) Shut OFF the house water valve.

(b) Press the **ENTER** key.



1 - Main Water Valve OFF

Figure 3-96. Main Water Valve

NOTE

Loosen connectors slowly to relieve any residual water pressure that may cause fluid sprays. Use caution when lifting decontamination reservoir. It is full and may spill.

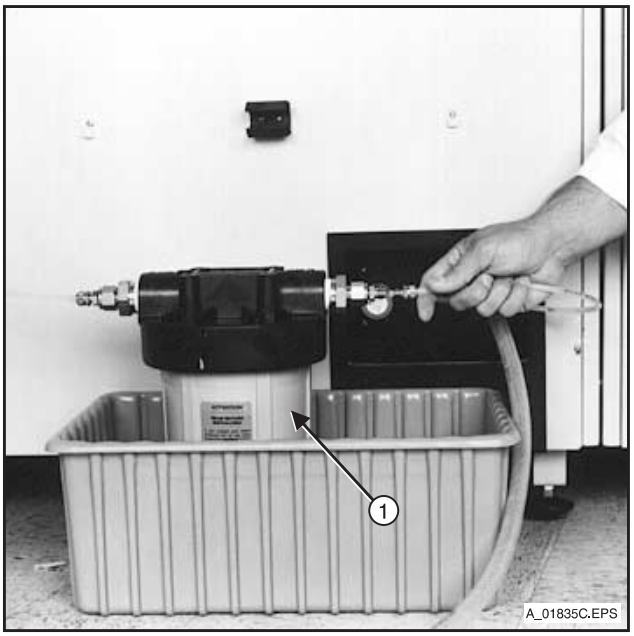
13. Remove the decontamination fluid reservoir.

(a) Empty and rinse with DI water.

(b) Fill with 70% isopropanol.

(c) Reinstall.

(d) Press the **ENTER** key.



1 - Decontamination Fluid Reservoir

Figure 3-97. Decontamination Fluid Reservoir

14.

(a) Remove spare dilute wash bottles 1 and 2.

(b) Remove spare DI water reservoir.

(c) Remove spare probe rinse bottle.

(d) Press the **ENTER** key.

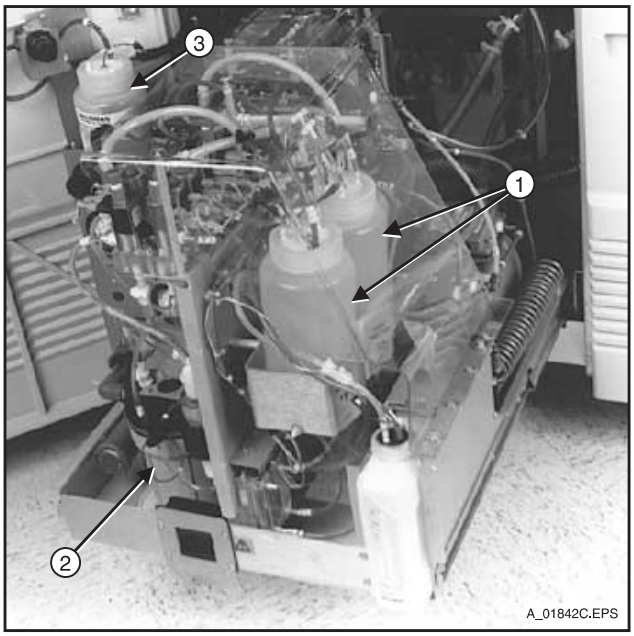
15.

(a) Install empty and cleaned *system* dilute wash bottles 1 and 2.

(b) Install empty and cleaned *system* DI water reservoir.

(c) Install clean *system* probe rinse bottle previously filled with 70% alcohol.

(d) Press the **ENTER** key.



1 - Dilute Wash Bottles 1 and 2
2 - DI Water Reservoir
3 - Probe Rinse Bottle

Figure 3-98. Hydropneumatics Assembly

16.

(a) Turn ON the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

17.

(a) Turn on the house water valve.

(b) Press the **ENTER** key. There is approximately a 15-minute delay at this step. During this time watch for leaks and perform the cleaning described in the following message which is now displayed on the screen:

"While the system is running, empty and rinse all spare containers. Fill the spare probe rinse bottle with DI water."

Press <PREV SCREEN> to exit"

Press the **PREV SCREEN** key to remove the window and wait for the system to highlight Step 18.

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

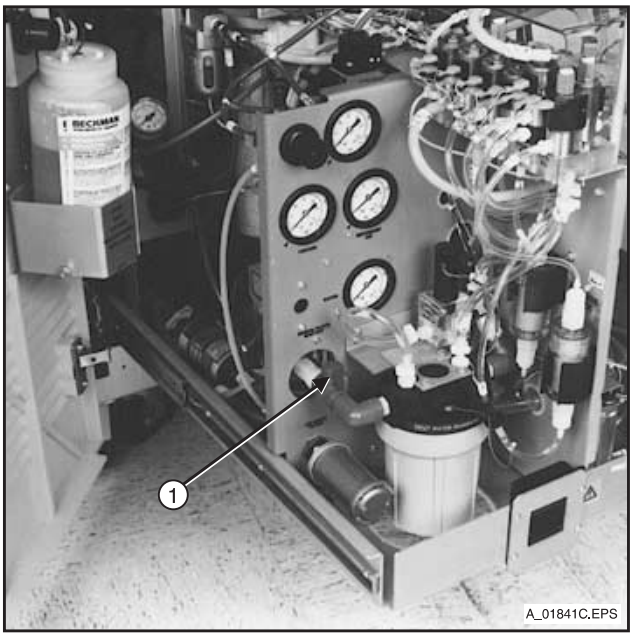
Check the connections and press the PREV SCREEN key to continue.

If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to return to the Diagnostics menu and contact the Clinical Support Center or your local Beckman representative.



1 - Main Water Valve ON.

Figure 3-99. Main Water Valve

18.

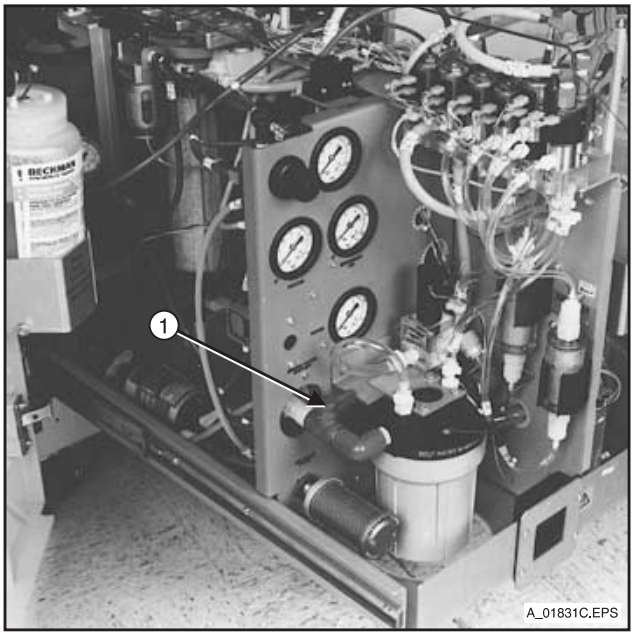
(a) Shut off the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

19.

(a) Shut OFF the house water valve.

(b) Press the **ENTER** key.



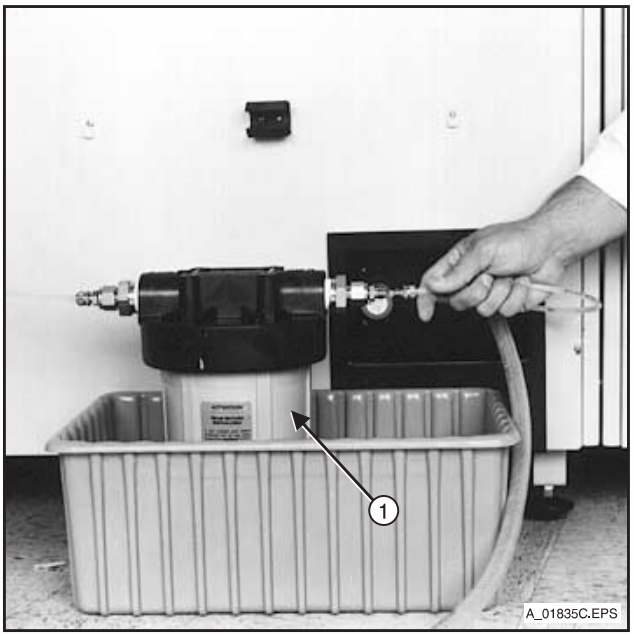
1 - Main Water Valve OFF

Figure 3-100. Main Water Valve

20.

(a) Remove the decontamination fluid reservoir.

(b) Press the **ENTER** key.



1 - Decontamination Fluid Reservoir

Figure 3-101. Decontamination Fluid Reservoir

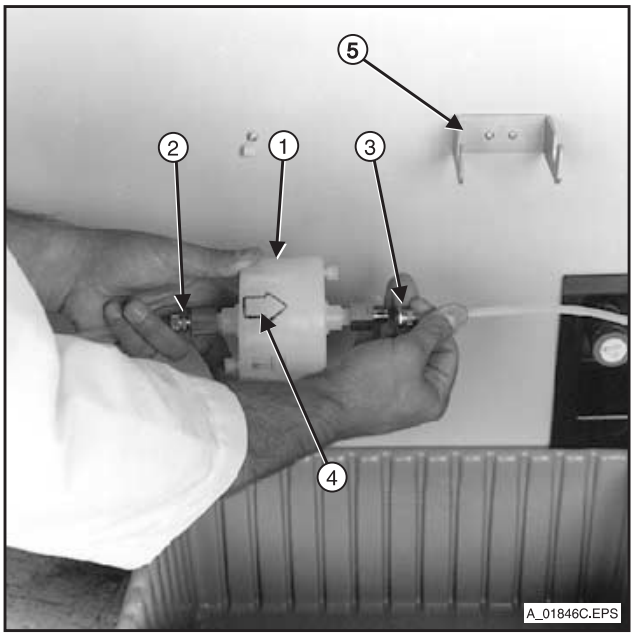
21. Install the new prefilter assembly.

    (a) Connect the new prefilter (via the new inlet line attached to the new prefilter) to the house water valve. The inlet side is at the tail of the direction-of-flow arrow.

    (b) Connect the outlet tubing of the new prefilter to the instrument. The outlet tubing is at the head of the direction-of-flow arrow.

    (c) Place filter in bracket.

    (d) Press the **ENTER** key.



1 - Inlet Prefilter
2 - Inlet Line (from Water Supply)
3 - Outlet Line (to instrument)
4 - Direction-of-Flow Arrow
5 - Bracket

Figure 3-102. Prefilter

22.

    (a) Remove system dilute wash bottles 1 and 2.

    (b) Press the **ENTER** key.

23.

    (a) Remove system DI water reservoir.

    (b) Remove system Probe rinse bottle.

    (c) Press the **ENTER** key.

24.

    (a) Install empty SPARE dilute wash bottles 1 and 2.

    (b) Press the **ENTER** key.

25.

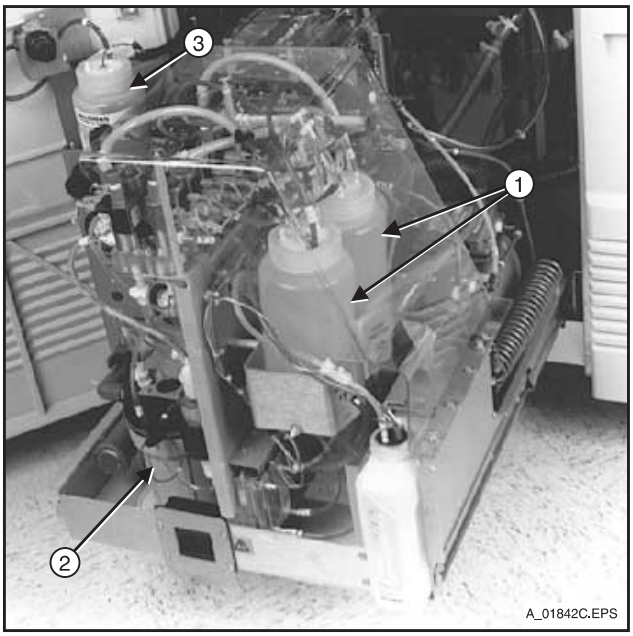
    (a) Install empty spare DI water reservoir.

    (b) Press the **ENTER** key.

26.

    (a) Install spare probe rinse bottle which has previously been filled with DI water.

    (b) Press the **ENTER** key.



1 - Dilute Wash Bottles 1 and 2
2 - DI Water Reservoir
3 - Probe Rinse Bottle

Figure 3-103. Hydropneumatics Assembly

27.

(a) Turn ON the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

28.

(a) Turn ON the house water valve.

(b) Press the **ENTER** key. There is approximately a 15-minute delay. During this time perform the cleaning steps described in the following note which is displayed on the screen at this time:

"While the system is running, empty and clean all system containers. Fill the system probe rinse bottle with probe rinse solution."

(c) Clean system containers: dilute wash bottles 1 and 2, and DI water reservoir as follows.

i. Partially fill container with Trace-Klean.

ii. Swirl or shake to coat interior surface.

iii. Scrub interior with a brush.

iv. Rinse container 10 times with DI water.

NOTE

If the water pressure is low at this step, a window will appear with this message:

"DI water level is low. Check main and house water valves and the inlet fluid connections.

Press <PREV SCREEN> to exit"

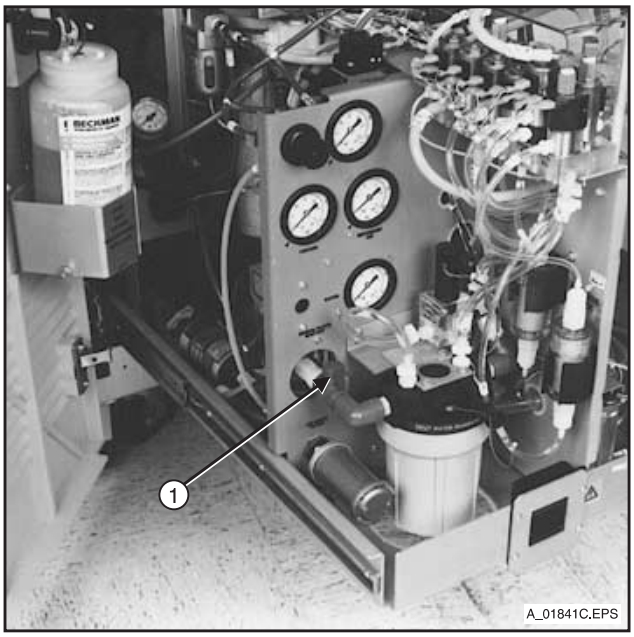
Check the connections and press the PREV SCREEN key to continue.

If the water pressure is still low, a new message will appear:

"DI water level is still low. DO NOT operate the instrument. Call HOTLINE for assistance.

Press <PREV SCREEN> to exit"

Press the PREV SCREEN key to initiate a return to the Diagnostics menu. Contact the Clinical Support Center or your local Beckman Representative.



1 - Main Water Valve ON

Figure 3-104. Main Water Valve

29.

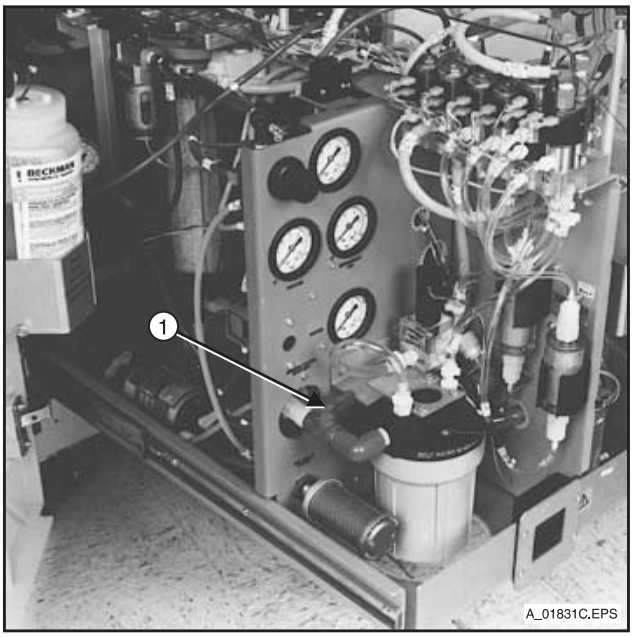
(a) Shut OFF the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.

30.

(a) Shut OFF the house water valve on the hydropneumatics.

(b) Press the **ENTER** key.



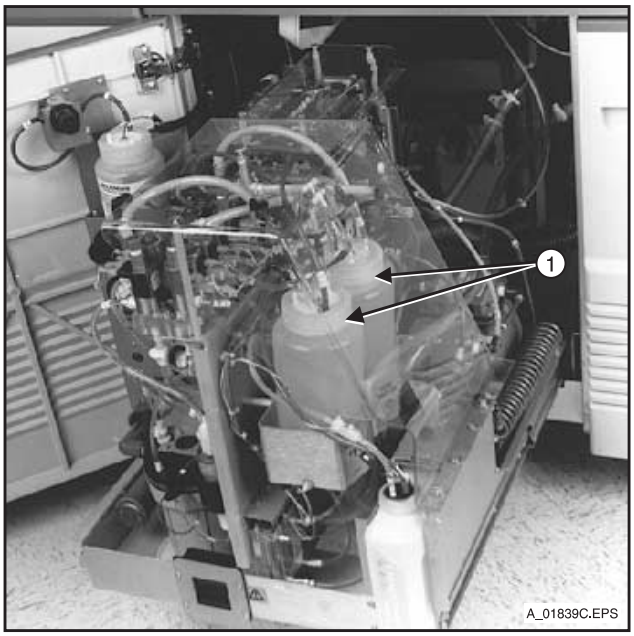
1 - Main Water Valve OFF

Figure 3-105. Main Water Valve

31.

(a) Remove spare dilute wash bottles 1 and 2.

(b) Press the **ENTER** key.



1 - Dilute Wash Bottles 1 and 2

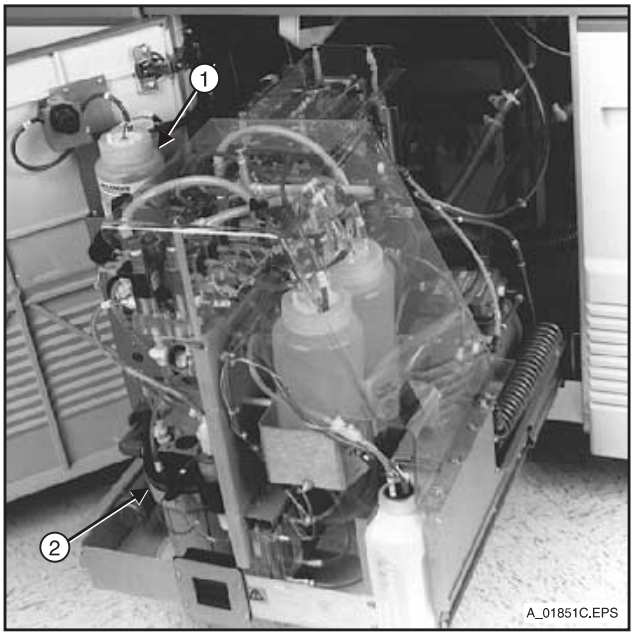
Figure 3-106. Dilute Wash Bottles

32.

(a) Remove spare DI water reservoir.

(b) Remove spare probe rinse bottle.

(c) Press the **ENTER** key.



1 - Probe Rinse Bottle
2 - DI Water Reservoir

Figure 3-107. Hydropneumatics Assembly

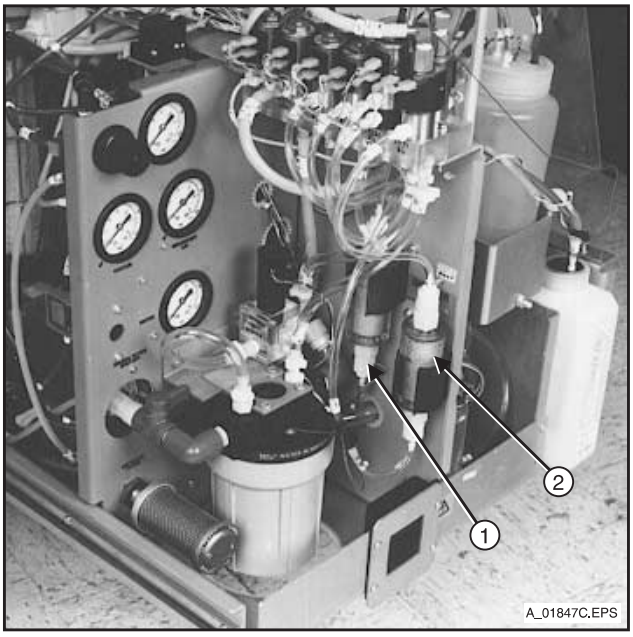
33. Remove the existing degasser assemblies.

NOTE

Some CX4s have two degassers (the syringe and ISE degassers). In this case both degassers must be changed.

(a) Locate the degassers in the hydropneumatics assembly.

(b) Carefully remove the degasser from its holder.

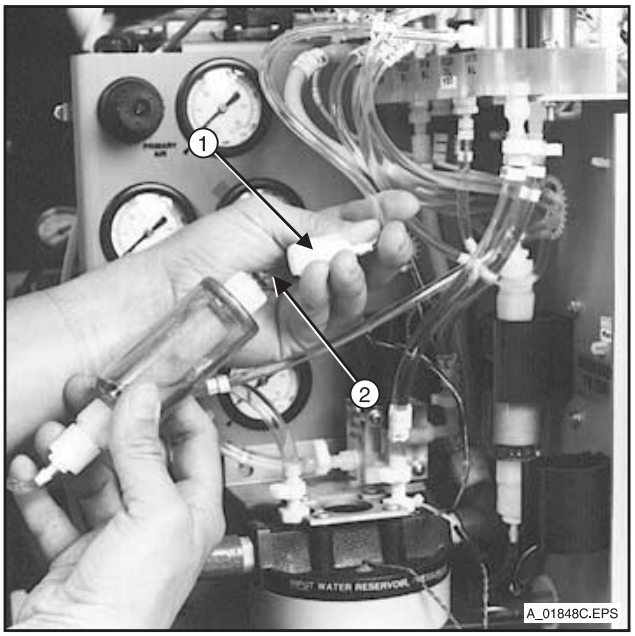


1 - Syringe Degasser Assembly
2 - ISE Degasser Assembly (CX5 Only)

Figure 3-108. Degasser Assembly

(c) Disconnect the tubing from both ends of the degasser by unscrewing the innermost white plastic nuts.

(d) Remove the O-ring from each end of the degasser and save for later installation.



1 - White Plastic Nut (One on Each End)
2 - Black O-ring (One on Each End)

Figure 3-109. Degasser

Install the New Degasser Assemblies:

(e) Install an O-ring on each end of one of the new degassers.

(f) Connect the tubing with the attached check valve to the inlet side of the degasser. The inlet side is at the tail of the direction-of-flow arrow.

(g) Connect the tubing labeled R10 attached to solenoid 1L to the outlet side of the degasser. The outlet side of the degasser is at the head of the direction-of-flow arrow.

NOTE

If an ISE degasser is also being changed, connect the tubing labeled Y7 attached to solenoid 6L to the outlet side of the degasser.

(h) Install the degasser into its holder.

(i) Press the **ENTER** key.

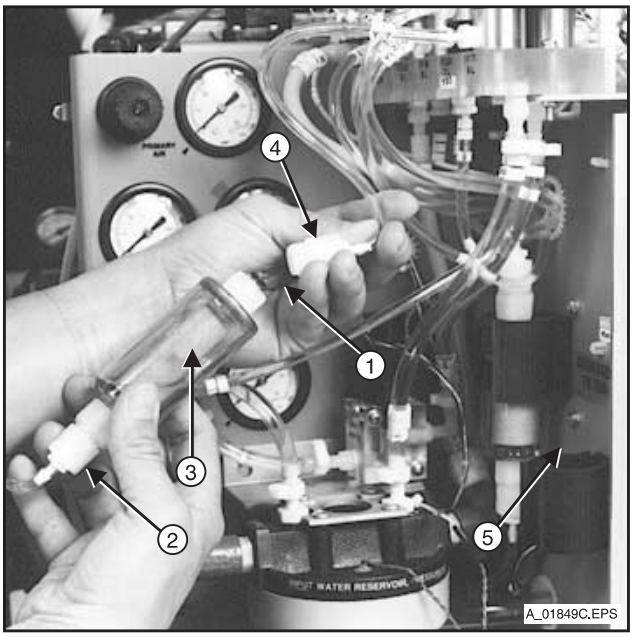
34.

(a) Install empty and cleaned system dilute wash bottles 1 and 2.

(b) Install empty and cleaned DI water reservoir.

(c) Install probe rinse bottle previously filled with dilute probe rinse solution.

(d) Press the **ENTER** key.



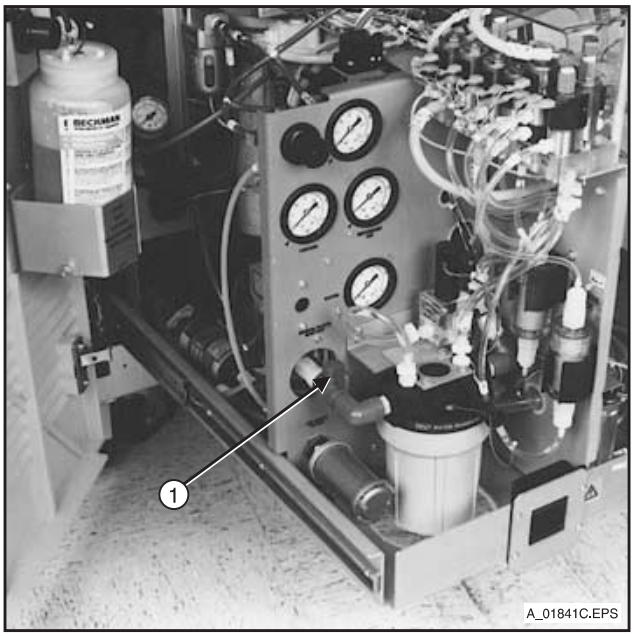
1 - Black O-ring (One on Each End)
2 - Inlet LIne
3 - Direction-of-Flow Arrow
4 - Outlet Line
5 - Degasser Holder

Figure 3-110. Degasser

35.

(a) Turn ON the main water valve on the hydropneumatics.

(b) Press the **ENTER** key.



1 - Main Water Valve ON

Figure 3-111. Main Water Valve

36.

(a) Turn ON the house water valve.

(b) Press the **ENTER** key. There is approximately a 15-minute delay at this step. During this time perform the cleaning as described in the following window that is now displayed on the screen:

"While the system is running empty and rinse all spare containers. Store them for next hydropneumatic cleaning."

(c) When the system has completed priming a note will appear:

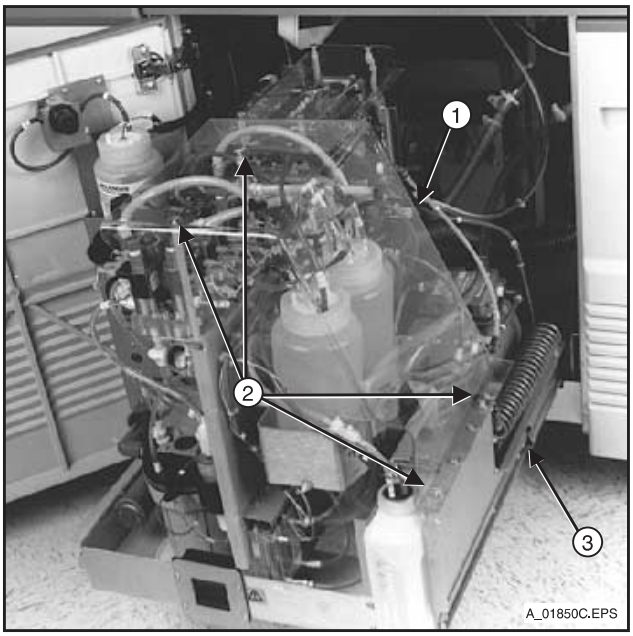
"The decontamination is complete. Please verify system operation by calibrating all onboard chemistries and running controls. Press <PREV SCREEN> to exit"

(d) Press the **PREV SCREEN** key to return to the Diagnostics menu.

37. Reinstall the hydropneumatic cover over the hydropneumatics.

38. Release the locking tabs on each side of the hydropneumatic drawer and slide the drawer back into the system.

39. Check fluid levels, calibrate applicable chemistries, and run controls to verify system operation.



1 - Hydropneumatics Cover
2 - 4 Attaching Screws
3 - Locking Tabs (One on Each Side)

Figure 3-112. Hydropneumatics Assembly

3.9 CX4 PERFORMANCE VERIFICATION

3.9.1 DESCRIPTION

The Performance Verification diagnostic functional area provides test procedures to validate sample and reagent delivery precision, photometric linearity, sample and reagent carryover and cuvette vacuuming.

3.9.1.1 Error Conditions

The following error conditions may be associated with this diagnostic module:

System imprecision
Low or high recovery
Nonlinearity
Cuvette wash station performance deficiencies

3.9.1.2 Test Location

TEST NAME	PARAGRAPH	TEST MODE
Photometric Check	3.9.2	Extended
Buffer Blank Run	3.9.3	Extended
Cuvette Dryness	3.9.4	Extended
Combined Carryover	3.9.5	Extended
Combined Dispensing	3.9.6	Extended
Wash All Cuvettes	3.9.7	Extended

3.9.2 CX4 PHOTOMETRIC CHECK

1. Test Summary. The Photometric Check procedure determines the photometric linearity and the relative noise level of the optical system. Three replicates of decreasing concentrations of test solutions are dispensed into a total of eighteen cuvettes and absorbance readings are taken. Photometric linearity is based on the difference between the low and high end absorbance, the slope, intercept, and coefficient of correlation. The level of photometric noise is based on the standard deviation of cuvette absorbance readings. The operator compares the test results to specifications given in the PVT1 test cartridge package insert to determine acceptable performance.

NOTE

Clear all error messages from the system console prior to starting this procedure. Any error messages remaining will prevent the procedure from starting.

2. Materials Required.
   (a) Photometric Check (PVT1) cartridge must be loaded on the reagent carousel (refer to the diagnostics ENTRY Screen for reagent load).
   (b) Photometric Check (PVT1) cartridge package insert with test specifications.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 9. Performance Verification, or type 9, **ENTER**.
   (e) Cursor and **SELECT** 1. Photometric Check, or type 1, **ENTER**.

4. Corrective Action. The following table lists the possible resolutions of a failed photometric check test procedure. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Photometric Check test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. High Level Difference, Slope, Intercept, and Coefficient of Correlation exceeds insert specifications.	1. Perform Analog Control diagnostic procedures: Blocked light test, Paragraph 3.3.4.6 ECR Verification, Paragraph 3.3.2.9 Lamp Energy, Paragraph 3.3.5.3 2. Verify adequate probe rinse solution volume and pressure. 3. Perform Scrub Bubble Test, Paragraph 3.8.3.3. Degraded test solution used. Repeat test with fresh cartridge. 4. Call the Clinical Support Center or your local Beckman representative.

3.9.3 BUFFER BLANK RUN

1. Test Summary. The Buffer Blank Run is designed to determine the number of cuvettes available for use in the Performance Verification testing and to determine cuvette blank absorbance values for all applicable Performance Verification test procedures. At the completion of the procedure, a listing of the cuvette status is given along with the cuvette requirements for the remaining Performance Verification procedures.

NOTE

Results obtained from the Buffer Blank Run are stored in memory for only as long as the diagnostics software is in operation. EXITING DIAGNOSTICS WILL DELETE ALL BUFFER BLANK RUN DATA.

Clear all error messages from the system console prior to beginning this procedure. Any error messages remaining will prevent procedure from starting.

2. Materials Required. Buffer Blank/Cuvette Dryness (PVT2) test cartridge must be loaded on the reagent carousel (refer to the diagnostics ENTRY Screen for reagent load).

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 9. Performance Verification, or type 9, **ENTER**.

   (e) Cursor to 2. Buffer Blank Run, or type 2. **ENTER**.

4. Corrective Action. If the test indicates excessive cuvettes unavailable:

   (a) Perform Wash All Cuvettes, Paragraph 3.9.7.

   (b) Perform Cuvette Maintenance, Section 9, in the Operating Instructions manual.

   (c) Perform Lamp Energy test, Paragraph 3.3.5.3.

   (d) Replace cuvettes indicated as "UNAVAILABLE".

   (e) Call the Clinical Support Center or your local Beckman representative.

3.9.4 CUVETTE DRYNESS

1. Test Summary. The Cuvette Dryness procedure evaluates the efficiency of the cuvette vacuuming after washing and rinsing. At the completion of the procedure, the system determines the mean and Standard Deviation (SD) of the fluid volume not vacuumed from the cuvettes serviced by either wash probe 5 or wash probe 6. The operator compares the test results to the specifications listed in the (PVT2) test cartridge package insert to determine acceptable performance.

NOTE

Clear all error messages from the system console prior to beginning this procedure. Any error messages remaining will prevent procedure from starting.

2. Materials Required.

   (a) The Buffer Blank Run must be performed prior to running this procedure (refer to Paragraph 3.9.3).

   (b) A minimum of 32 cuvettes available as indicated by the Buffer Blank Run.

(c) The Buffer Blank/Cuvette Dryness test reagent cartridge (PVT2) must be loaded on the reagent carousel (refer to the diagnostics ENTRY Screen for reagent load).

(d) PVT2 test cartridge package insert with specifications.

NOTE

It is possible to perform both the Buffer Blank Run AND the Cuvette Dryness procedure from one PVT2 test cartridge.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 9. Performance Verification, or type 9, **ENTER**.

   (e) Cursor to 3. Cuvette Dryness, or type 3, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Cuvette Dryness test. If the test fails again, continue to the next corrective action step.

   (a) Check cuvette wipers. (Refer to Section 9 in the Operating Instructions manual.)

   (b) Verify cuvette wash station probe deflection (refer to Paragraph 3.7.5).

   (c) Check cuvette wash station lines, fittings, bottle caps, and tubing for leaks and drips. If probes are dripping, the check valve is suspected. Call the Clinical Support Center or your local Beckman representative.

   (d) Check for probe occlusion (refer to Paragraph 3.8.2.4).

   (e) Call the Clinical Support Center or your local Beckman representative.

3.9.5 CX4 COMBINED CARRYOVER

1. Test Summary. The Combined Carryover test is designed to evaluate carryover properties of the reagent probe, reagent mixer, sample probe, sample mixer, and the cuvette wash station.

NOTE

Clear all error messages from the system console prior to beginning this procedure. Any error messages remaining will prevent procedure from starting.

2. Materials Required.

   (a) The Buffer Blank Run must be performed prior to running this test (refer to Paragraph 3.9.3).

   (b) A minimum of 65 cuvettes available as indicated by the Buffer Blank Run.

   (c) Combined Carryover test cartridge (PVT3) must be loaded on the reagent carousel (refer to the diagnostics ENTRY Screen for reagent load).

   (d) PVT3 test cartridge package insert with specifications.

   (e) Approximately 1.0 mL PVT3 Sample A. (Protect from light.)

   (f) Approximately 2.0 mL PVT3 Sample B. (Protect from light.)

   (g) One sector with sample cups in positions 1 and 2.

3. Test Access. From the diagnostics MAIN MENU Screen:

   (a) Press **F2 SETUP OPTIONS** to select operation mode.

   (b) Press **SELECT** to set EXTENDED mode.

   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.

   (d) Cursor and **SELECT** 9. Performance Verification, or type 9, **ENTER**.

   (e) Cursor and **SELECT** 4. Combined Carryover, or type 4, **ENTER**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the Combined Carryover test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent Carryover Test Mean ABS exceeds the package insert specification.	1. Perform reagent probe maintenance (refer to Section 9 in Operating Instructions.) 2. Check for burrs, nicks, or scratches on reagent probe and mixer. 3. Verify reagent probe and mixer alignment by performing Paragraphs 3.6.2.2 and 3.6.3.2. 4. Perform External Probe Wash test, Paragraph 3.8.2.3. 5. Perform Scrub Bubble Test, Paragraph 3.8.2.4. 6. Call the Clinical Support Center or your local Beckman representative.
2. Sample Carryover Test Mean ABS exceeds the package insert specification.	1. Perform sample probe maintenance (refer to Section 9 in Operating Instructions.) 2. Check for burrs, nicks, or scratches on sample probe and mixer. 3. Verify sample probe alignment by performing Paragraphs 3.5.2.2 and 3.5.3.2. 4. Perform External Probe Wash test, Paragraph 3.8.2.3. 5. Call the Clinical Support Center or your local Beckman representative.
3. Wash Carryover Test mean ABS exceeds the package insert specification.	1. Perform wash probe maintenance (refer to Section 9 in Operating Instructions.) 2. Verify adequate cuvette vacuuming (refer to Paragraph 3.9.4). 3. Call the Clinical Support Center or your local Beckman representative.

3.9.6 COMBINED DISPENSING

1. Test Summary. The Combined Dispensing test is designed to evaluate the precision of small volume reagent delivery and the precision of both small and large volume sample delivery. At test completion the system calculates the coefficient of variation (CV) of the C-Component (small reagent volume), absorbance readings, the mean and CV of the small sample dispense, and the absorbance CV of the large sample dispense. The operator compares the test results to the specifications given in the PVT4 cartridge package insert to determine adequate performance.

NOTE

Clear all error messages from the system console prior to beginning this procedure. Any error messages remaining will prevent procedure from starting.

2. Materials Required.
   (a) The Buffer Blank Run must be completed prior to performing this test (refer to Paragraph 3.9.3).
   (b) A minimum 65 cuvettes available as indicated by the Buffer Blank Run.
   (c) Combined Dispensing test cartridge (PVT4) must be loaded on the reagent carousel (refer to diagnostics ENTRY Screen for reagent load)
   (d) PVT4 test cartridge package insert with specifications.
   (e) Sample sector with a 2.0 mL sample cup in positions 3 and 4.
   (f) Approximately 2.0 mL of PVT4 Sample C and Sample D. (Protect from light.)
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 9. Performance Verification, or type 9, **ENTER**.
   (e) Cursor and **SELECT** 5. Combined Dispensing, or type 5, **ENTER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the Combined Dispensing test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. C-Component Dispensing: Test Absorbance CV exceeds package insert specification.	1. Check for air bubbles in reagent probe line and syringe pump. 2. Perform Scrub Bubble test, Paragraph 3.8.2.4. 3. Perform reagent probe maintenance (refer to Section 9 in Operating Instructions). 4. Verify reagent probe wash station operation (refer to Paragraph 3.8.2.3). 5. Replace reagent probe syringe tip (refer to Section 9 in Operating Instructions). 6. Verify sample probe alignment by performing Paragraphs 3.5.2.2 and 3.5.3.2. 7. Perform Sample Mixer Spin test, Paragraph 3.5.3.4.
2. Sample Dispensing: Calculated Volume Mean, Calculated Volume CV, and/or Test Absorbance CV exceeds the package insert specifications.	1. Check for air bubbles in sample probe line and syringe. 2. Check for sample probe occlusion. 3. Replace sample probe syringe tip (refer to Section 9 in Operating Instructions). 4. Call the Clinical Support Center or your local Beckman representative.

3.9.7 WASH ALL CUVETTES

1. Test Summary. The Wash All Cuvettes procedure allows the operator to wash all 80 cuvettes in the reaction carousel at an accelerated rate. This procedure may be used if the Buffer Blank Run indicates an excessive number of cuvettes not available for use in other Performance Verification procedures.

NOTE

Clear all error messages from the system console prior to beginning this procedure. Any error messages remaining will prevent procedure from starting.

2. Materials Required. None.
3. Test Access. From the diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to set EXTENDED mode.
   (c) Press **PREV SCREEN** to return to diagnostics MAIN MENU Screen.
   (d) Cursor and **SELECT** 9. Performance Verification, or type 9, **ENTER**.
   (e) Cursor and **SELECT** 6. Wash All Cuvettes, or type 6, **ENTER**.
4. Corrective Action. None.

3.10 CX3 ELECTRONIC TESTS

3.10.1 DESCRIPTION

The Electronic Tests functional area exercises the Central Processing Unit (CPU) Board, which coordinates CX3 motion, interfaces with the user through a data console and calculates answers to CX3 chemistry tests. This functional area also verifies correct operation of the Master Motion Controller System. These boards are responsible for controlling movement of the CX3 sample crane, multi-pinch valves, ratio pump, solenoid pinch valves, stir motors and peristaltic pumps.

3.10.1.1 Error Conditions

The following error conditions are associated with this diagnostic module:

CX3 Sample Crane Motion Errors

3.10.1.2 Modules

The following modules are tested in the Electronics Tests functional area:

CPU Board
MMC System
ADC System

3.10.1.3 Test Location

TEST NAME	PARAGRAPH
CPU Board	3.10.2
MMC System	3.10.3
MMC Board	3.10.3.1
MTR1 Board	3.10.3.2
MTR2 Board	3.10.3.3
ADC System	3.10.4
ADC Board	3.10.4.1
Analog1 Board	3.10.4.2
Analog2 Board	3.10.4.3
Analog3 Board	3.10.4.4

3.10.2 CX3 CPU BOARD

1. Test Summary. This option performs all CPU Board tests.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F1 ELECTRONIC TESTS**.
   (b) Press **F1 CPU BOARD**.

(c) Press **F1 START TEST**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the CPU Board Test. If the test fails again, continue to the next corrective action step.

   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).

   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.10.3 CX3 MASTER MOTION CONTROLLER SYSTEM

The Master Motion Controller System consists of the Master Motion Controller board, the Motor Driver 1 Board and the Motor Driver 2 Board. These boards are responsible for controlling movement of the CX3 sample crane, multi-pinch valves, ratio pump, solenoid pinch valves, stir motors and peristaltic pumps.

3.10.3.1 MMC Board

1. Test Summary. This test resets the Master Motion Controller Board and reloads the MMC operating program from the system console hard disk.

2. Materials Required. None.

3. Test Access. From the CX3 diagnostics MAIN MENU Screen:

   (a) Press **F1 ELECTRONIC TESTS**.

   (b) Press **F2 MMC SYSTEM**.

   (c) Press **F1 MMC BOARD**.

   (d) Press **F1 START TEST**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MMC Board Test. If the test fails again, continue to the next corrective action step.

   (a) Place the MMC Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).

   (b) The MMC Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.10.3.2 MTR1 Board

1. Test Summary. This test verifies communication from the Motor Driver 1 Board to the Master Motion Controller Board. This is accomplished by exercising the sample crane and the alkaline buffer peristaltic pump.

2. Materials Required. None.

3. Test Access. From the CX3 diagnostics MAIN MENU Screen:

   (a) Press **F1 ELECTRONIC TESTS**.

   (b) Press **F2 MMC SYSTEM**.

   (c) Press **F2 MTR1 BOARD**.

   (d) Press **F1 START TEST**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MTR1 Board Test. If the test fails again, continue to the next corrective action step.

   (a) Place the MTR1 Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).

   (b) The MTR1 Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.10.3.3 MTR2 Board

1. Test Summary. This test verifies communication from the Motor Driver 2 Board to the Master Motion Controller Board. This is accomplished by exercising the sample turntable and the BUN stirrer motor for 5 seconds.

2. Materials Required. None.

3. Test Access. From the CX3 diagnostics MAIN MENU Screen:

   (a) Press **F1 ELECTRONIC TESTS**.

   (b) Press **F2 MMC SYSTEM**.

   (c) Press **F3 MTR2 BOARD**.

   (d) Press **F1 START TEST**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MTR2 Board Test. If the test fails again, continue to the next corrective action step.

   (a) Place the MTR2 Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).

   (b) The MTR2 Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.10.4 ADC SYSTEM

The ADC Board Diagnostic Tests are unavailable at this time.

3.11 CX3 MECHANICAL TESTS

3.11.1 Description

The Mechanical Tests functional area verifies correct sample probe positions, stirrer motor performance, multi-pinch valve movements, solenoid pinch valve movements, peri-pump operation and ratio pump piston operation.

3.11.1.1 Error Conditions

The following error conditions are associated with this diagnostic module:

Stirrer Motor Malfunction
Multi-Pinch Valve Malfunction
Solenoid Valve Malfunction
Ratio Pump Motion Errors or Leakage
Peri-pump Malfunction

3.11.1.2 Modules

The following modules are tested in the Mechanical Tests functional area:

Sample Probe
Stirrer Motors
Multivalves
Solenoid Valves
Peristaltic Pumps
Ratio Pump

3.11.1.3 Test Location

TEST NAME	PARAGRAPH
Sample Probe	3.11.2
Auto Cycle	3.11.2.1
Select Position	3.11.2.2
Probe Up/Down	3.11.2.3
Home Probe	3.11.2.4
Stirrer Motors	3.11.3
BUN Str Mtr	3.11.3.1
GLU Str Mtr	3.11.3.2
CA Str Mtr	3.11.3.3
CRE Str Mtr	3.11.3.4
TP Str Mtr	3.11.3.5
Multivalves	3.11.4
ECAM Auto	3.11.4.1
ECAM Sel Pos	3.11.4.2
ECAM Home	3.11.4.3
CCAM Auto	3.11.4.4
CCAM Sel Pos	3.11.4.5
CCAM Home	3.11.4.6
Solenoid Valves	3.11.5
Alkaline Buffer	3.11.5.1
Flow Cell	3.11.5.2
Wash/Waste	3.11.5.3
Peristaltic Pumps	3.11.6
Drain/Wash	3.11.6.1
Alkaline Buffer	3.11.6.2
Electrolyte Reference	3.11.6.3
BUN/TP (or CA) Sip/Drn	3.11.6.4
GLU/CRE Sip/Drn	3.11.6.5
Fill Pumps	3.11.6.6
Ratio Pump	3.11.7
Auto Cycle	3.11.7.1
Up/Down Pump	3.11.7.2
Home Pump	3.11.7.3

3.11.2 CX3 SAMPLE PROBE

3.11.2.1 Auto Cycle

1. Test Summary. This test cycles the sample probe through various positions. It first homes the probe (over the electrolyte injection cup), then moves the probe to the following positions: total protein cup (or calcium cup), glucose cup, BUN cup, electrolyte injection cup, creatinine cup, and sample carousel. The probe is then returned to the home position.

2. Materials Required. None.

3. Test Access. From the CX3 diagnostics MAIN MENU Screen:

   (a) Press **F2 MECHANICAL TESTS**.

   (b) Press **F2 SAMPLE PROBE**.

   (c) Press **F1 AUTO CYCLE**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the AUTO CYCLE test. If the test fails again, continue to the next corrective action step.

(a) Verify that there are no obstructions blocking movement of the sample probe.

(b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.2.2 Select Position

1. Test Summary. This test allows the selection of specific sample probe positions.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F2 SELECT POSITION**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the SELECT POSITION test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.2.3 Probe Up/Down

1. Test Summary. This test moves the probe to either the up or down position to facilitate sample probe arm adjustment.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F4 PROBE UP/DOWN**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the PROBE UP/DOWN test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.2.4 Home Probe

1. Test Summary. This test moves the sample probe to the home position, over the electrolyte injection cup.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F5 HOME PROBE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the HOME PROBE test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.3 CX3 STIRRER MOTORS

3.11.3.1 BUN Stirrer Motor

1. Test Summary. This test turns the BUN stirrer motor ON.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F3 STR MTRS**.
   (c) Press **F1 BUN STR MTR**.

NOTE

To verify stirrer motor performance, observe stirrer (magnet) rotation in reaction cup.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the BUN STR MTR test. If the test fails again, continue to the next corrective action step.

NOTE

Before proceeding to corrective action, it is recommended that maintenance be performed on the cup and stirrer. Refer to Section 9 in Operating Instructions.

(a) Remove module and inspect for evidence of reagent leakage. Rotate motor shaft by hand.

(b) Motor driver board is suspected. Refer to Paragraph 3.10.3.

(c) Stirrer motor may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.3.2 Glucose Stirrer Motor

1. Test Summary. This test turns the GLU stirrer motor ON.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F3 STR MTRS**.
   (c) Press **F2 GLU STR MTR**.

NOTE

To verify stirrer motor performance, observe stirrer (magnet) rotation in reaction cup.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the GLU STR MTR test. If the test fails again, continue to the next corrective action step.

NOTE

Before proceeding to corrective action, it is recommended that maintenance be performed on the cup and stirrer. Refer to Section 9 in Operating Instructions.

(a) Remove module and inspect for evidence of reagent leakage. Rotate motor shaft by hand.

(b) Motor driver board is suspected. Refer to Paragraph 3.10.3.

(c) Stirrer motor may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.3.3 Calcium Stirrer Motor

1. Test Summary. This test turns the CA stirrer motor ON.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F3 STR MTRS**.
   (c) Press **F3 CA STR MTR**.

NOTE

To verify stirrer motor performance, observe stirrer (magnet) rotation in reaction cup.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the CA STR MTR test. If the test fails again, continue to the next corrective action step.

NOTE

Before proceeding to corrective action, it is recommended that maintenance be performed on the cup and stirrer. Refer to Section 9 in Operating Instructions.

(a) Remove module and inspect for evidence of reagent leakage. Rotate motor shaft by hand.

(b) Motor driver board is suspected. Refer to Paragraph 3.10.3.

(c) Stirrer motor may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.3.4 Creatinine Stirrer Motor

1. Test Summary. This test turns the CRE stirrer motor ON.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F3 STR MTRS**.
   (c) Press **F4 CRE STR MTR**.

NOTE

To verify stirrer motor performance, observe stirrer (magnet) rotation in reaction cup.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the CRE STR MTR test. If the test fails again, continue to the next corrective action step.

NOTE

Before proceeding to corrective action, it is recommended that maintenance be performed on the cup and stirrer. Refer to Section 9 in Operating Instructions.

   (a) Remove module and inspect for evidence of reagent leakage. Rotate motor shaft by hand.
   (b) Motor driver board is suspected. Refer to Paragraph 3.10.3.
   (c) Stirrer motor may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.3.5 Total Protein Stirrer Motor

1. Test Summary. This test turns the TP stirrer motor ON.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F3 STR MTRS**.
   (c) Press **F3 TP STR MTR**.

NOTE

To verify stirrer motor performance, observe stirrer (magnet) rotation in reaction cup.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the TP STR MTR test. If the test fails again, continue to the next corrective action step.

NOTE

Before proceeding to corrective action, it is recommended that maintenance be performed on the cup and stirrer. Refer to Section 9 in Operating Instructions.

   (a) Remove module and inspect for evidence of reagent leakage. Rotate motor shaft by hand.
   (b) Motor driver board is suspected. Refer to Paragraph 3.10.3.
   (c) Stirrer motor may need to be replaced. Call the Clinical support Center or your local Beckman representative.

3.11.4 CX3 MULTIVALVES

The "E" CAM valve controls fluid delivery to the flow cell. The "C" CAM valve controls reagent fluids drained and sipped from the glucose, BUN, creatinine and calcium or total protein reaction cups.

3.11.4.1 'E" CAM Auto

1. Test Summary. This test moves the cam on the multi-pinch valve "E" through each of the cam positions.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F1 'E" CAM AUTO** .
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action

step, repeat the "E" CAM AUTO test. If the test fails again, continue to the next corrective action step.

(a) Verify that there are no obstructions to the "E" cam.

(b) Call the Clinical Support Center or your local Beckman representative.

3.11.4.2 "E" CAM Select Position

1. Test Summary. This test allows selection of specific cam positions on the multi-pinch valve "E".
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F2 E CAM SEL POS**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the E CAM SEL POS test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "E" cam, then press **F3 E CAM HOME**.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.11.4.3 "E" CAM Home

1. Test Summary. This test moves the multi-pinch valve "E" cam to the home position (#3).
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F3 E CAM HOME**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the E CAM HOME test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "E" cam.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.11.4.4 "C" CAM Auto

1. Test Summary. This test moves the cam on the multi-pinch valve "C" stepwise through each of the cam positions.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F4 C CAM AUTO**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the C CAM AUTO test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "C" cam.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.11.4.5 "C" CAM Select Position

1. Test Summary. This test allows selection of specific cam positions on the multi-pinch valve "C".
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F5 C CAM SEL POS**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the C CAM SEL POS test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "C" cam. then press **F6 C CAM HOME**.

(b) Call the Clinical Support Center or your local Beckman representative.

3.11.4.6 "C" CAM Home

1. Test Summary. This test moves the multi-pinch valve "C" cam to the home position (#1).
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F6 C CAM HOME**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the C CAM HOME test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "C" cam.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.11.5 CX3 SOLENOID VALVES

3.11.5.1 Alkaline Buffer

1. Test Summary. This test opens and closes the alkaline buffer solenoid pinch valve.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F5 SOLENOID VALVES**.
   (c) Press **F1 ALKALINE BUFFER**.

NOTE

A clicking sound may be heard each time the solenoid pinch valve opens or closes. All solenoid pinch valves automatically return to the closed position upon leaving the Solenoid Valves Test Screen.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ALKALINE BUFFER test. If the test fails again, continue to the next corrective action step.

CAUTION

Do not exit screen with tubing removed from pinch valve, as backflow of reagents into system components may occur.

SYMPTOM	CORRECTIVE ACTION
1. Solenoid valve does not open.	1. Remove tubing from pinch valve and inspect for crimps. 2. Gently roll tubing between two fingers until crimp in tubing is gone. 3. Replace tubing back in solenoid pinch valve. Be sure to move the part of the tubing that was crimped to the right or left of the pinch valve. 4. Call the Clinical Support Center or your local Beckman representative.

3.11.5.2 Flow Cell

1. Test Summary. This test moves the sample probe to the home position (over the electrolyte injection cup). The probe then moves down into the injection cup, thus blocking any backflow of reagent into the flow cell. The flow cell solenoid pinch valve will then open and close as selected.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F5 SOLENOID VALVES**.
   (c) Press **F2 FLOW CELL**.

NOTE

A clicking sound may be heard each time the solenoid pinch valve opens or closes. All solenoid pinch valves automatically return to the closed position upon leaving the Solenoid Valves Test Screen.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the FLOW CELL test. If the test fails again, continue to the next corrective action step.

CAUTION

Do not exit screen with tubing removed from pinch valve, as backflow of reagents into system components may occur.

SYMPTOM	CORRECTIVE ACTION
1. Solenoid valve does not open.	1. Remove tubing from pinch valve and inspect for crimps. 2. Gently roll tubing between two fingers until crimp in tubing is gone. 3. Replace tubing back in solenoid pinch valve. Be sure to move the part of the tubing that was crimped to the right or left of the pinch valve. 4. Call the Clinical Support Center or your local Beckman representative.

3.11.5.3 Drain/Wash

1. Test Summary. This test opens and closes the wash/waste solenoid pinch valve.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F5 SOLENOID VALVES**.
   (c) Press **F3 WASH/WASTE**.

NOTE

A clicking sound may be heard each time the solenoid pinch valve opens or closes. All solenoid pinch valves automatically return to the closed position upon leaving the Solenoid Valves Test Screen.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the DRAIN/WASH test. If the test fails again, continue to the next corrective action step.

CAUTION

Do not exit screen with tubing removed from pinch valve, as backflow of reagents into system components may occur.

SYMPTOM	CORRECTIVE ACTION
1. Solenoid valve does not open.	1. Remove tubing from pinch valve and inspect for crimps. 2. Gently roll tubing between two fingers until crimp in tubing is gone. 3. Replace tubing back in solenoid pinch valve. Be sure to move the part of the tubing that was crimped to the right or left of the pinch valve. 4. Call the Clinical Support Center or your local Beckman representative.

3.11.6 CX3 PERISTALTIC PUMPS

3.11.6.1 Drain/Wash

1. Test Summary. This test checks the electrolyte injection cup drain and wash peri-pumps. First, the injection cup drain pump is turned on for several seconds to prevent overfill of the electrolyte injection cup. Then the injection cup wash pump turns on for several seconds.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMPS**.
   (c) Press **F1 DRAIN/WASH**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the DRAIN/WASH test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.11.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.17. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.10.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.11.6.2 Alkaline Buffer

1. Test Summary. This test turns the alkaline buffer peri-pump on for several seconds.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMPS**.
   (c) Press **F2 ALKALINE BUFFER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ALKALINE BUFFER test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.11.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.17. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.10.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.11.6.3 Electrolyte Reference

1. Test Summary. This test turns the electrolyte peri-pump on for several seconds.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI-PUMP**.
   (c) Press **F3 ELECTROLYTE REF.**
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ELECTROLYTE REFERENCE test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.11.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.17. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions. 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.10.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.11.6.4 BUN/TP (or CA) Sip/Drain

1. Test Summary. This test moves the "C" CAM pinch valve to the home position (#3). The BUN/TP (or CA) sip/drain peri-pump turns on for several seconds.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMP**.
   (c) Press **F4 BUN/TP (or CA) SIP/DRN**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the BUN/TP (or CA) SIP/DRN test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.11.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.17. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions. 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.10.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.11.6.5 GLU/CRE Sip/Drain

1. Test Summary. This test moves the "C" CAM pinch valve to position #4. The glucose/creatinine sip/drain peri-pump turns on for several seconds.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMP**.
   (c) Press **F5 GLU/CRE SIP/DRN**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the GLU/CRE SIP/DRN test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.11.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.17. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions. 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.10.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.11.6.6 Fill Pumps

1. Test Summary. This test turns on the fill pumps for the selected chemistry.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMP**.
   (c) Press **F6 FILL PUMPS**.
   (d) Press **F1 BUN**, **F2 GLU**, **F3 TP/CA**, or **F4 CRE** to select the desired chemistry.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the FILL PUMPS test. If the test fails again, continue to the next corrective action step.
   (e) Replace the defective pump (Refer to Paragraph 4.17) or call the Clinical Support Center or your local Beckman representative.

3.11.7 CX3 RATIO PUMP

3.11.7.1 Auto Cycle

1. Test Summary. This test moves the multi-pinch valve “E” CAM to the home position (#3). This prevents any disturbance from occurring in the flow cell. The ratio pump piston moves to the full DOWN position and then returns to the full UP position.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F7 RATIO PUMP**.
   (c) Press **F1 AUTO CYCLE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the AUTO CYCLE test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Ratio pump does not move up or down as expected.	1. Remove any obstructions. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.
2. Ratio pump appears to be leaking.	1. Perform ratio pump maintenance. Refer to Section 9 in the Operator’s Manual. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.7.2 Up/Down Pump

1. Test Summary. This test moves the multi-pinch valve “E” CAM to the home position (#3). This prevents any disturbance from occurring in the flow cell. The ratio pump piston is moved to either the UP or DOWN position as appropriate.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F7 RATIO PUMP**.
   (c) Press **F2 UP/DOWN PUMP**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the UP/DOWN PUMP test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Ratio pump does not move up or down as expected.	1. Remove any obstructions, then press **F5 HOME PUMP**. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.
2. Ratio pump appears to be leaking.	1. Perform ratio pump maintenance. Refer to Section 9 in the Operator's Manual. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.11.7.3 Home Pump

1. Test Summary. This test moves the multi-pinch valve "E" CAM to the home position (#3). This prevents any disturbance from occurring in the flow cell. The ratio pump piston moves to the full UP (home) position.
2. Materials Required. None.
3. Test Access. From the CX3 diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F7 RATIO PUMP**.
   (c) Press **F5 HOME PUMP**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the HOME PUMP test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Ratio pump does not move up or down as expected.	1. Remove any obstructions. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.
2. Ratio pump appears to be leaking.	1. Perform ratio pump maintenance. Refer to Section 9 in the Operator's Manual. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.12 CX3 CHEMISTRY TESTS

The chemistry tests are unavailable at this time.

3.13 ISE ELECTRONIC TESTS

3.13.1 DESCRIPTION

The Electronic Tests functional area exercises the Central Processing Unit (CPU) Board, which coordinates ISE motion, interfaces with the user through a data console and calculates answers to ISE chemistry tests. This functional area also verifies correct operation of the Master Motion Controller System. These boards are responsible for controlling movement of the ISE sample crane, multi-pinch valves, ratio pump, solenoid pinch valves, and peristaltic pumps.

3.13.1.1 Error Conditions

The following error conditions are associated with this diagnostic module:

ISE Sample Crane Motion Errors

3.13.1.2 Modules

The following modules are tested in the Electronics Tests functional area:

CPU Board
MMC System
ADC System

3.13.1.3 Test Location

TEST NAME	PARAGRAPH
CPU Board	3.13.2
MMC System	3.13.3
MMC Board	3.13.3.1
MTR1 Board	3.13.3.2
ADC System	3.13.4
ADC Board	3.13.4.1
Analog1 Board	3.13.4.2

3.13.2 ISE CPU BOARD

1. Test Summary. This option performs all CPU Board tests.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F1 ELECTRONIC TESTS**.
   (b) Press **F1 CPU BOARD**.
   (c) Press **F1 START TEST**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the CPU Board Test. If the test fails again, continue to the next corrective action step.
   (a) Place the CPU Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).
   (b) The CPU Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.13.3 ISE MASTER MOTION CONTROLLER SYSTEM

The Master Motion Controller System consists of the Master Motion Controller board the Motor Driver 1 Board. These boards are responsible for controlling movement of the ISE sample crane, multi-pinch valves, ratio pump, solenoid pinch valves, and peristaltic pumps.

3.13.3.1 MMC Board

1. Test Summary. This test resets the Master Motion Controller Board and reloads the MMC operating program from the system console hard disk.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F1 ELECTRONIC TESTS**.
   (b) Press **F2 MMC SYSTEM**.
   (c) Press **F1 MMC BOARD**.
   (d) Press **F1 START TEST**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MMC Board Test. If the test fails again, continue to the next corrective action step.
   (a) Place the MMC Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).
   (b) The MMC Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.13.3.2 MTR1 Board

1. Test Summary. This test verifies communication from the Motor Driver 1 Board to the Master Motion Controller Board. This is accomplished by exercising the sample crane and the alkaline buffer peristaltic pump.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F1 ELECTRONIC TESTS**.
   (b) Press **F2 MMC SYSTEM**.
   (c) Press **F2 MTR1 BOARD**.
   (d) Press **F1 START TEST**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the MTR1 Board Test. If the test fails again, continue to the next corrective action step.
   (a) Place the MTR1 Board on a flat surface and gently press down on all the chips (refer to Paragraph 4.4 for procedure on removing board).
   (b) The MTR1 Board is suspected; call the Clinical Support Center or your local Beckman representative.

3.13.4 ADC SYSTEM

The ADC Board Diagnostic Tests are unavailable at this time.

3.14 ISE MECHANICAL TESTS

3.14.1 Description

The Mechanical Tests functional area verifies correct sample probe positions, multi-pinch valve movements,

solenoid pinch valve movements, peri-pump operation and ratio pump piston operation.

3.14.1.1 Error Conditions

The following error conditions are associated with this diagnostic module:

Multi-Pinch Valve Malfunction
Solenoid Valve Malfunction
Ratio Pump Motion Errors or Leakage
Peri-pump Malfunction

3.14.1.2 Modules

The following modules are tested in the Mechanical Tests functional area:

Sample Probe
Multivalves
Solenoid Valves
Peristaltic Pumps
Ratio Pump

3.14.1.3 Test Location

TEST NAME	PARAGRAPH
Sample Probe	3.14.2
Auto Cycle	3.14.2.1
Select Position	3.14.2.2
Probe Up/Down	3.14.2.3
Home Probe	3.14.2.4
Multivalves	3.14.3
ECAM Auto	3.14.3.1
ECAM Sel Pos	3.14.3.2
ECAM Home	3.14.3.3
Solenoid Valves	3.14.4
Alkaline Buffer	3.14.4.1
Flow Cell	3.14.4.2
Wash/Waste	3.14.4.3
Peristaltic Pumps	3.14.5
Drain/Wash	3.14.5.1
Alkaline Buffer	3.14.5.2
Electrolyte Reference	3.14.5.3
Fill Pumps	3.14.5.4
Ratio Pump	3.14.6
Auto Cycle	3.14.6.1
Up/Down Pump	3.14.6.2
Home Pump	3.14.6.3

3.14.2 ISE SAMPLE PROBE

3.14.2.1 Auto Cycle

1. Test Summary. This test cycles first homes the probe (over the electrolyte injection cup), then moves the probe to the sample carousel. The probe is then returned to the home position.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F1 AUTO CYCLE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the AUTO CYCLE test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.14.2.2 Select Position

1. Test Summary. This test allows the selection of specific sample probe positions.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F2 SELECT POSITION**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the SELECT POSITION test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.14.2.3 Probe Up/Down

1. Test Summary. This test moves the probe to either the up or down position to facilitate sample probe arm adjustment.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F4 PROBE UP/DOWN**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the PROBE UP/DOWN test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.14.2.4 Home Probe

1. Test Summary. This test moves the sample probe to the home position, over the electrolyte injection cup.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F2 SAMPLE PROBE**.
   (c) Press **F5 HOME PROBE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the HOME PROBE test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions blocking movement of the sample probe.
   (b) Sample probe/crane may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.14.3 ISE MULTIVALVE

The "E" CAM multivalve controls fluid delivery to the flow cell.

3.14.3.1 'E" CAM Auto

1. Test Summary. This test moves the cam on the multi-pinch valve "E" through each of the cam positions.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F1 'E" CAM AUTO** .
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the "E" CAM AUTO test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "E" cam.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.14.3.2 'E" CAM Select Position

1. Test Summary. This test allows selection of specific cam positions on the multi-pinch valve "E".
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F2 E CAM SEL POS**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the E CAM SEL POS test. If the test fails again, continue to the next corrective action step.
   (a) Verify that there are no obstructions to the "E" cam, then press **F3 E CAM HOME**.
   (b) Call the Clinical Support Center or your local Beckman representative.

3.14.3.3 'E" CAM Home

1. Test Summary. This test moves the multi-pinch valve "E" cam to the home position (#3).
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F4 MULTI VALVES**.
   (c) Press **F3 E CAM HOME**.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the E CAM HOME test. If the test fails again, continue to the next corrective action step.

   (a) Verify that there are no obstructions to the "E" cam.

   (b) Call the Clinical Support Center or your local Beckman representative.

3.14.4 ISE SOLENOID VALVES

3.14.4.1 Alkaline Buffer

1. Test Summary. This test opens and closes the alkaline buffer solenoid pinch valve.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:

   (a) Press **F2 MECHANICAL TESTS**.

   (b) Press **F5 SOLENOID VALVES**.

   (c) Press **F1 ALKALINE BUFFER**.

NOTE

A clicking sound may be heard each time the solenoid pinch valve opens or closes. All solenoid pinch valves automatically return to the closed position upon leaving the Solenoid Valves Test Screen.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ALKALINE BUFFER test. If the test fails again, continue to the next corrective action step.

CAUTION

Do not exit screen with tubing removed from pinch valve, as backflow of reagents into system components may occur.

SYMPTOM	CORRECTIVE ACTION
1. Solenoid valve does not open.	1. Remove tubing from pinch valve and inspect for crimps. 2. Gently roll tubing between two fingers until crimp in tubing is gone. 3. Replace tubing back in solenoid pinch valve. Be sure to move the part of the tubing that was crimped to the right or left of the pinch valve. 4. Call the Clinical Support Center or your local Beckman representative.

3.14.4.2 Flow Cell

1. Test Summary. This test moves the sample probe to the home position (over the electrolyte injection cup). The probe then moves down into the injection cup, thus blocking any backflow of reagent into the flow cell. The flow cell solenoid pinch valve will then open and close as selected.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:

   (a) Press **F2 MECHANICAL TESTS**.

   (b) Press **F5 SOLENOID VALVES**.

   (c) Press **F2 FLOW CELL**.

NOTE

A clicking sound may be heard each time the solenoid pinch valve opens or closes. All solenoid pinch valves automatically return to the closed position upon leaving the Solenoid Valves Test Screen.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the FLOW CELL test. If the test fails again, continue to the next corrective action step.

CAUTION

Do not exit screen with tubing removed from pinch valve, as backflow of reagents into system components may occur.

SYMPTOM	CORRECTIVE ACTION
1. Solenoid valve does not open.	1. Remove tubing from pinch valve and inspect for crimps. 2. Gently roll tubing between two fingers until crimp in tubing is gone. 3. Replace tubing back in solenoid pinch valve. Be sure to move the part of the tubing that was crimped to the right or left of the pinch valve. 4. Call the Clinical Support Center or your local Beckman representative.

3.14.4.3 Drain/Wash

1. Test Summary. This test opens and closes the wash/waste solenoid pinch valve.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F5 SOLENOID VALVES**.
   (c) Press **F3 WASH/WASTE**.

NOTE

A clicking sound may be heard each time the solenoid pinch valve opens or closes. All solenoid pinch valves automatically return to the closed position upon leaving the Solenoid Valves Test Screen.

4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the DRAIN/WASH test. If the test fails again, continue to the next corrective action step.

CAUTION

Do not exit screen with tubing removed from pinch valve, as backflow of reagents into system components may occur.

SYMPTOM	CORRECTIVE ACTION
1. Solenoid valve does not open.	1. Remove tubing from pinch valve and inspect for crimps. 2. Gently roll tubing between two fingers until crimp in tubing is gone. 3. Replace tubing back in solenoid pinch valve. Be sure to move the part of the tubing that was crimped to the right or left of the pinch valve. 4. Call the Clinical Support Center or your local Beckman representative.

3.14.5 ISE PERISTALTIC PUMPS

3.14.5.1 Drain/Wash

1. Test Summary. This test checks the electrolyte injection cup drain and wash peri-pumps. First, the injection cup drain pump is turned on for several seconds to prevent overfill of the electrolyte injection cup. Then the injection cup wash pump turns on for several seconds.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMPS**.
   (c) Press **F1 DRAIN/WASH**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the DRAIN/WASH test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.14.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.33. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.13.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.14.5.2 Alkaline Buffer

1. Test Summary. This test turns the alkaline buffer peri-pump on for several seconds.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI PUMPS**.
   (c) Press **F2 ALKALINE BUFFER**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ALKALINE BUFFER test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.14.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.33. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.13.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.14.5.3 Electrolyte Reference

1. Test Summary. This test turns the electrolyte peri-pump on for several seconds.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F6 PERI-PUMP**.
   (c) Press **F3 ELECTROLYTE REF.**
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the ELECTROLYTE REFERENCE test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Reagent/waste overflow.	1. Tubing may be crimped or obstructed. Refer to Paragraph 3.14.4.
2. Peri-pump does not rotate smoothly.	1. Remove peri-pump tubing from suspected pump and from an identical pump that is working properly. 2. Remove both pump assemblies and switch pump positions. Be sure connectors are reinstalled. Refer to Paragraph 4.33. 3. Replace peri-pump tubing onto both assemblies. Attach all reagent input and output lines as appropriate. Refer to Section 9 in Operating Instructions. 4. If the peri-pump that was previously functioning properly rotates smoothly, the non-working peri-pump may need to be replaced. 5. If the peri-pump that was previously functioning properly does NOT rotate smoothly, the Motor driver board is suspect. Refer to Paragraph 3.13.3. 6. Call the Clinical Support Center or your local Beckman representative.

3.14.6 ISE RATIO PUMP

3.14.6.1 Auto Cycle

1. Test Summary. This test moves the multi-pinch valve "E" CAM to the home position (#3). This prevents any disturbance from occurring in the flow cell. The ratio pump piston moves to the full DOWN position and then returns to the full UP position.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F7 RATIO PUMP**.
   (c) Press **F1 AUTO CYCLE**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the AUTO CYCLE test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Ratio pump does not move up or down as expected.	1. Remove any obstructions. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.
2. Ratio pump appears to be leaking.	1. Perform ratio pump maintenance. Refer to Section 9 in the Operator's Manual. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.14.6.2 Up/Down Pump

1. Test Summary. This test moves the multi-pinch valve "E" CAM to the home position (#3). This prevents any disturbance from occurring in the flow cell. The ratio pump piston is moved to either the UP or DOWN position as appropriate.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F7 RATIO PUMP**.
   (c) Press **F2 UP/DOWN PUMP**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the UP/DOWN PUMP test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Ratio pump does not move up or down as expected.	1. Remove any obstructions, then press **F5 HOME PUMP**. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.
2. Ratio pump appears to be leaking.	1. Perform ratio pump maintenance. Refer to Section 9 in the Operator's Manual. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.14.6.3 Home Pump

1. Test Summary. This test moves the multi-pinch valve "E" CAM to the home position (#3). This prevents any disturbance from occurring in the flow cell. The ratio pump piston moves to the full UP (home) position.
2. Materials Required. None.
3. Test Access. From the ISE diagnostics MAIN MENU Screen:
   (a) Press **F2 MECHANICAL TESTS**.
   (b) Press **F7 RATIO PUMP**.
   (c) Press **F5 HOME PUMP**.
4. Corrective Action. If the test fails, it is recommended that the steps described below be performed in the order listed. If an adjustment is made in response to a failed corrective action step, repeat the HOME PUMP test. If the test fails again, continue to the next corrective action step.

SYMPTOM	CORRECTIVE ACTION
1. Ratio pump does not move up or down as expected.	1. Remove any obstructions. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.
2. Ratio pump appears to be leaking.	1. Perform ratio pump maintenance. Refer to Section 9 in the Operator's Manual. 2. Ratio pump may need to be replaced. Call the Clinical Support Center or your local Beckman representative.

3.15 ISE CHEMISTRY TESTS

The chemistry tests are unavailable at this time.

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Section 4
USER SERVICING

This section provides information for use in servicing the CX4, CX5, and CX7 customer-replaceable parts. The user may be instructed to replace a part either in the diagnostics or troubleshooting sections of this manual or by a Beckman representative. If difficulties occur while performing any of the procedures, contact the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

CX4

4.1 AUTOLOADER ROTARY ALIGNMENT

While the instrument is in STANDBY, perform the following steps:

1. Loosen the screw located on top of the autoloader (Figure 4-1).
2. Adjust the rotary position of the autoloader so that the autoloader flanges are centered between the sample carousel flanges.

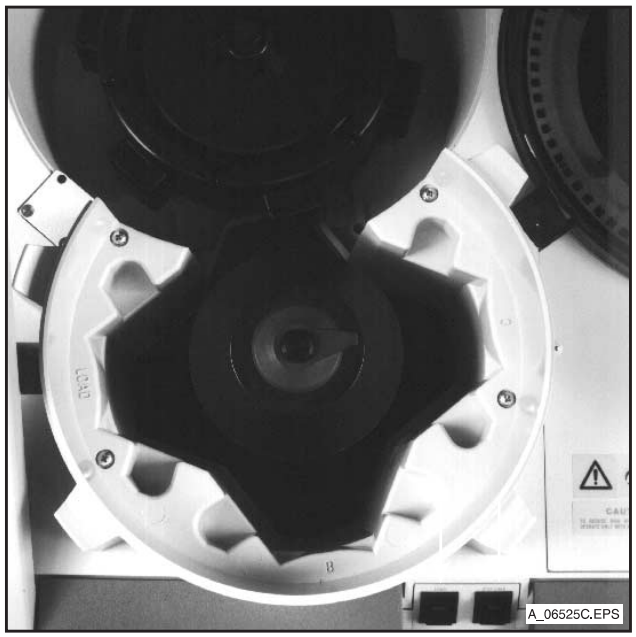


Figure 4-1. Loosen Autoloader Screw

3. Tighten the screw.
4. Press START to verify acceptable autoloader alignment.

4.2 BAR CODE READER REPLACEMENT

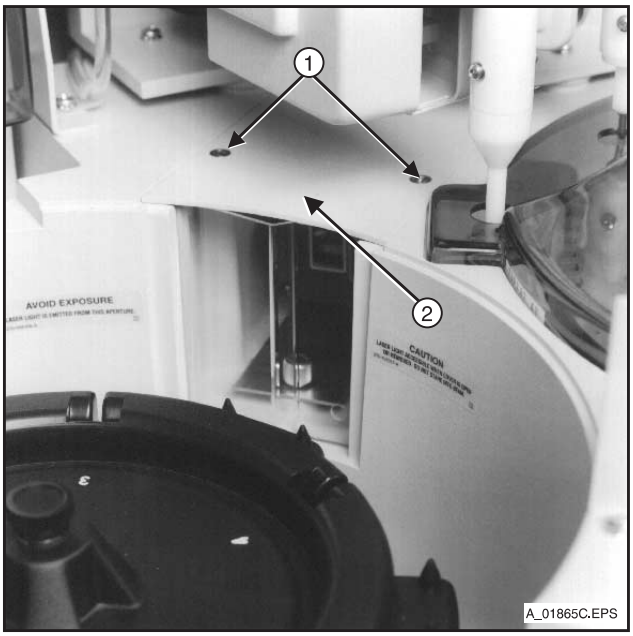
WARNING

DO NOT TAMPER WITH OR REMOVE HOUSING OF SAMPLE BAR CODE READER.

The sample bar code reader is a Class II moving beam laser scanner. When the instrument status on the console displays the messages “Running”, “Homing”, or “Diagnostics”, the laser may be on. At all other times, the laser is off.

4.2.1 Sample Bar Code Reader Removal and Replacement

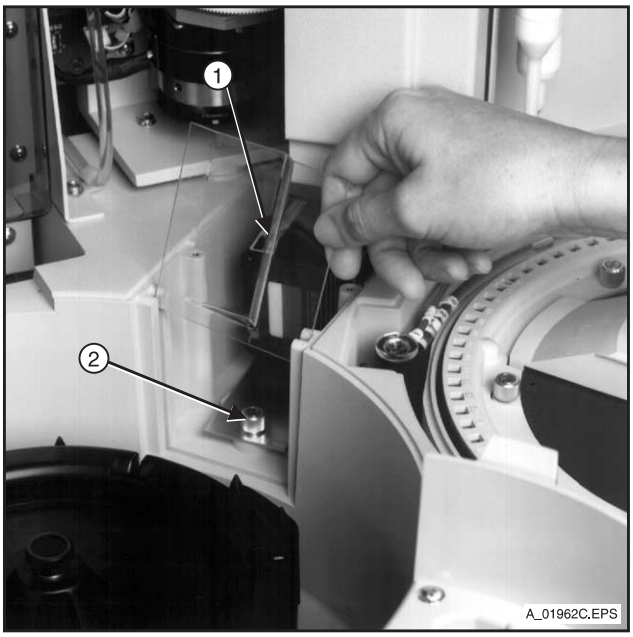
1. From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
2. Cursor and **SELECT** 3. Diagnostics/Alignment or type 3 **ENTER**.
3. Press F4 CX4 Diag. If the screen prompts “Entering CX4 Diagnostics requires 5 minutes. Do you wish to continue (Y/N)?” Press **Y**.
4. From the CX4 diagnostics MAIN MENU Screen press **F2 SETUP OPTIONS** to select operation mode.
5. Press **SELECT** to enter into the **EXTENDED** Mode.
6. Remove covers to autoloader and sample carousel.
7. Unpack replacement reader at this point and place it in an accessible location next to the autoloader.
8. Loosen the two captive screws on the top of the reader (Figure 4-2). Lift off the cover of the sample bar code reader.



1 - Retaining Screws
2 - Bar Code Reader Cover

Figure 4-2. Remove Sample Bar Code Reader Cover.

9. Remove bar code reader window by lifting it up and out (Figure 4-3).



1 - Bar Code Reader Window
2 - Thumbscrew

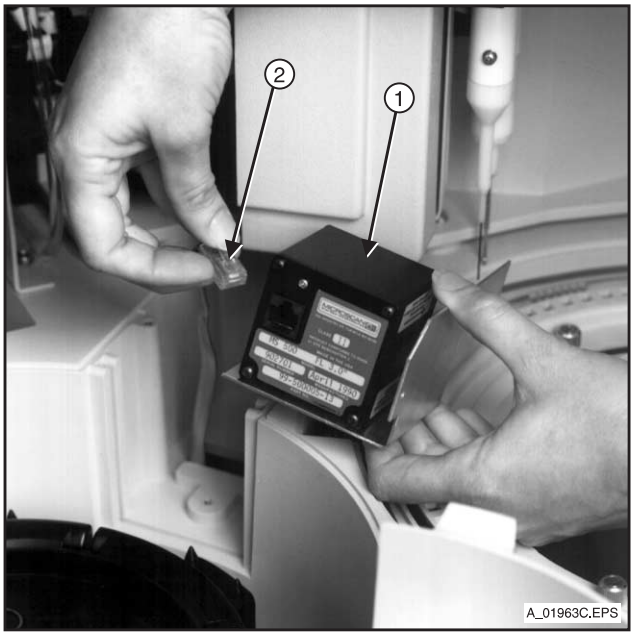
Figure 4-3. Remove Bar Code Reader Window

10. Remove thumbscrew and lift bar code reader up so that cable and connector are accessible.

11. Disconnect cable by pushing down on tab with thumb and separate reader assembly from connector. Hold on to cable to prevent it from falling into reader well (Figure 4-4).

NOTE

Orientation of the sample bar code reader on the CX DELTA system will vary from a non CX DELTA system. Cable connector is configured and will only plug into reader one way.



1 - Sample Bar Code Reader (non CX DELTA System)
2 - Cable with Connector

Figure 4-4. Sample Bar Code Reader Cable

12. Connect cable to replacement reader assembly.
13. Install replacement reader into well and reinstall thumbscrew.
14. Replace clean bar code reader window by sliding window into slots. Refer to the appropriate Operator's Manual for cleaning instructions and orientation of sample bar code reader window.

15. Replace metal cover and tighten the two captive screws (Figure 4-5).

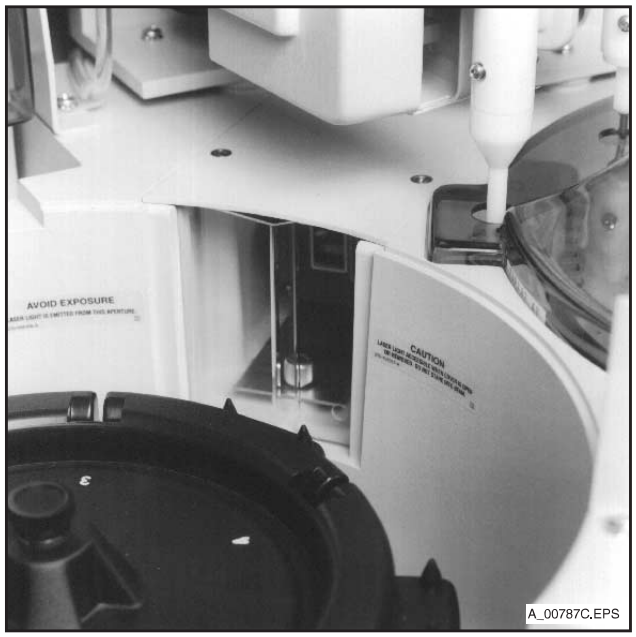
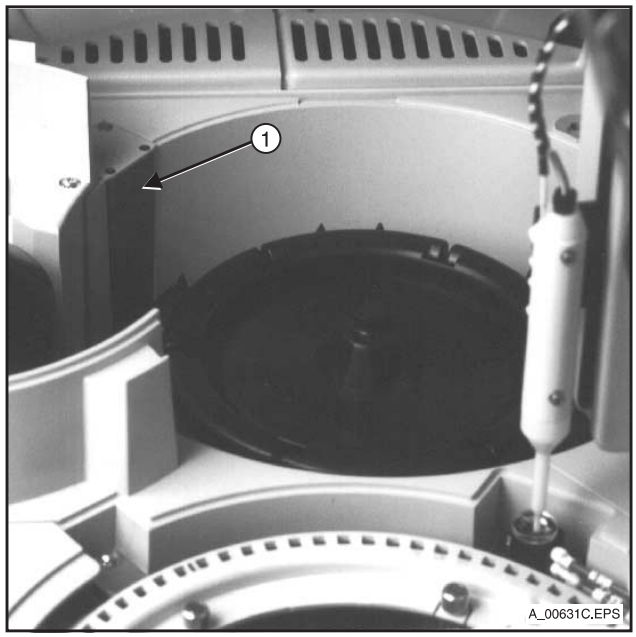


Figure 4-5. Replacing Sample Bar Code Reader Cover

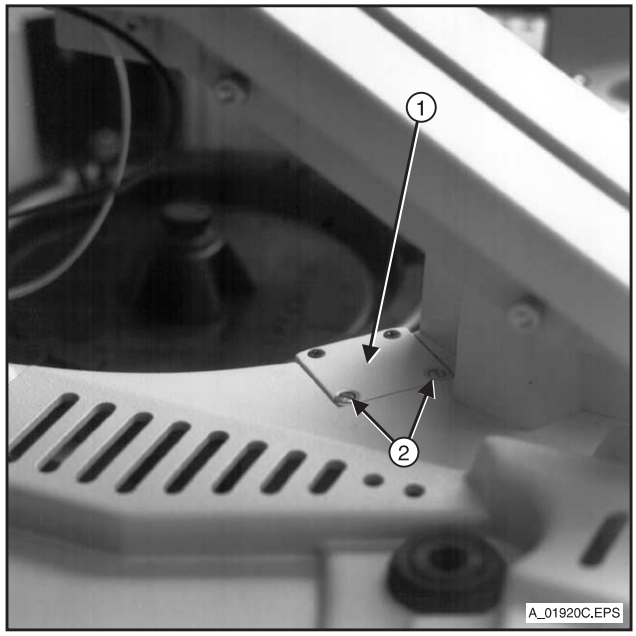
16. Follow the procedure in Section 3.5 to make sure the sample bar code reader is reading sample IDs correctly.
17. Replace covers.

4.2.2 Sector Bar Code Reader Replacement (non CX DELTA Systems only)

1. From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
2. Cursor and **SELECT** 3. Diagnostics/Alignment or type 3 **ENTER**.
3. Press **F4 CX4 Diag**. If the screen prompts "Entering CX4 Diagnostics requires 5 minutes. Do you wish to continue (Y/N)?" Press **Y**.
4. From the CX4 diagnostics MAIN MENU Screen press **F2 SETUP OPTIONS** to select operation mode.
5. Press **F2 SETUP OPTIONS**.
6. Press **SELECT** to enter into the EXTENDED Mode.
7. Remove covers to autoloader and sample carousel.
8. Unpack replacement reader at this point and place it in an accessible location next to the autoloader.
9. Remove the two rear screws from the top of the reader. Set screws aside (Figure 4-6A and B).



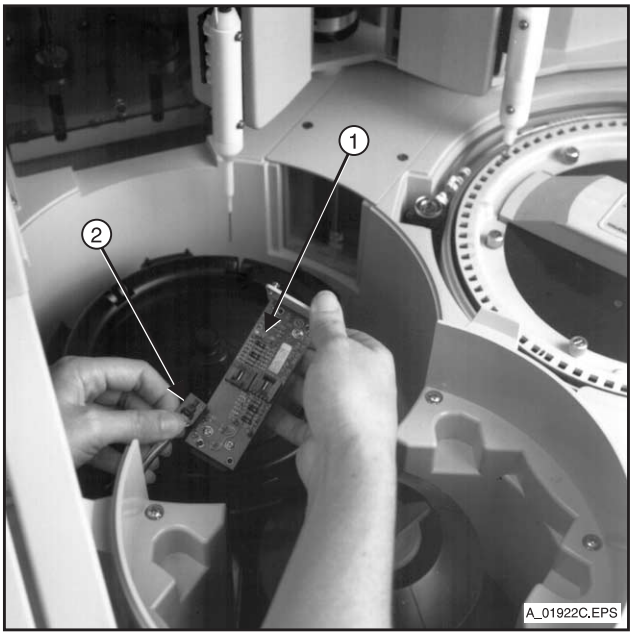
A
1 - Sample Sector Reader



B
1 - Sample Sector Reader
2 - Rear Screws

Figure 4-6. Sample Sector Reader

10. Lift reader up so that cable and connector are accessible.
11. Disconnect cable by pushing down on tab with thumb and separate reader assembly from connector. Hold on to cable to prevent it from falling into reader well (Figure 4-7).



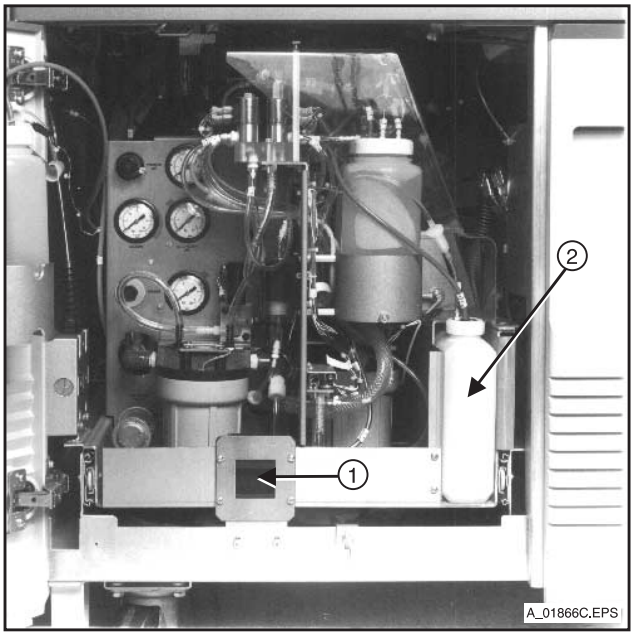
1 - Sample Sector Reader
2 - Cable with Connector

Figure 4-7. Sector Reader Cable

12. Connect cable to replacement reader assembly.
13. Install replacement reader into well.
14. Reinstall the two rear screws.
15. Align the sector reader. (For instructions, refer to Section 3.5.4.3 SAMPLE CAROUSEL - Read Sector.)
16. Replace covers.

4.3 BOTTLE CAP AND FLOAT SWITCH REPLACEMENT (WASH CONCENTRATE)

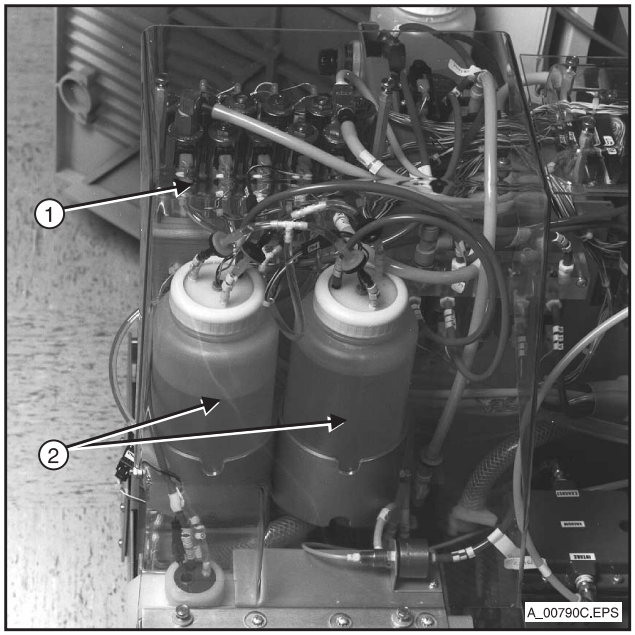
1. Release the pressure from the Wash Concentrate Bottle.
   (a) From MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance Procedures, or type 6 **ENTER**.
   (c) Cursor and **SELECT** 4. Hydropneumatic Shutdown or type 4 **ENTER**.
2. Open left panel door. Release hydropneumatics drawer latch and slide drawer out for easy access to wash concentrate bottle (Figure 4-8).



1 - Latch (Pull up to Release)
2 - Wash Concentrate Bottle

Figure 4-8. Hydropneumatics

3. Unscrew thumbscrews from top of clear plastic hydropneumatics cover and set aside (Figure 4-9).



1 - Cover
2 - Diluted Wash Bottle

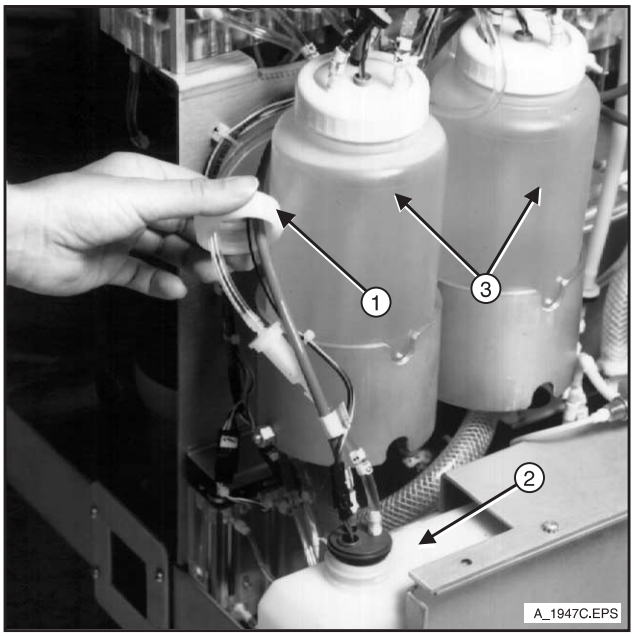
Figure 4-9. Hydropneumatics Cover

CAUTION

Slowly unscrew bottle cap to relieve residual pressure.

4. Slide wash bottle partially out.

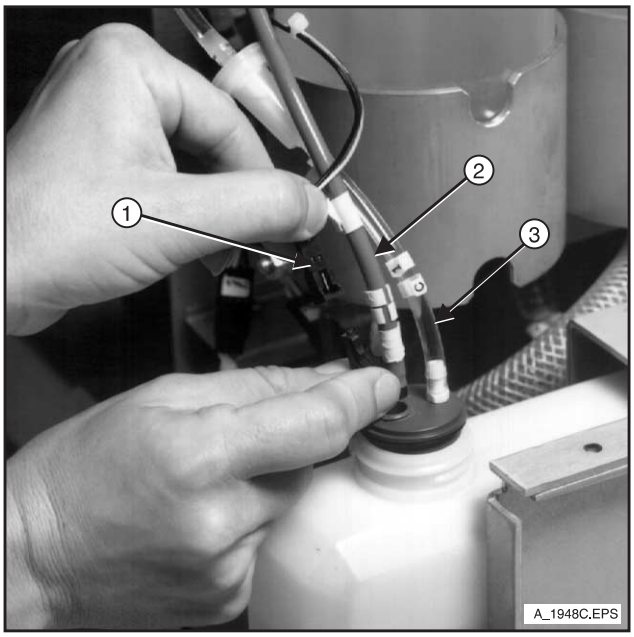
5. Unscrew cap and slide cap up over in-line filter (Figure 4-10).



1 - Wash Concentrate Cap
2 - Wash Concentrate Bottle
3 - Diluted Wash Bottles

Figure 4-10. Wash Bottles

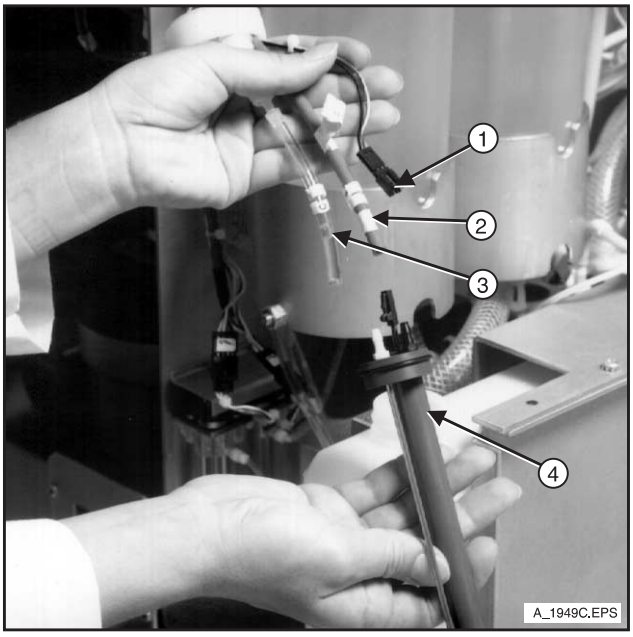
6. Disconnect float switch by pressing down tab on plug and gently separating cable from connector (Figure 4-11).



1 - Connector
2 - Green Low Pressure Supply Line
3 - Fluid Supply Line

Figure 4-11. Float Switch Connector

7. Carefully disconnect the green low pressure tube and clear wash concentrate line from the top of the float switch.
8. If wash concentrate bottle cap replacement is necessary, remove cap.
9. Install new cap. Be sure to pull all three lines through cap before reconnecting them to the replacement float switch assembly.
10. Connect green low pressure line, clear wash concentrate line and cable connector to top of replacement float switch assembly (Figure 4-12).



1 - Connector
2 - Green Low Pressure Supply Line
3 - Fluid Supply Line
4 - Float Switch

Figure 4-12. Reconnect Lines to Float Switch Assembly

11. Seat replacement float switch assembly into wash concentrate bottle, seat cap, and tighten down.
12. Press **PREV SCREEN** to complete procedure.
13. Check for leaks. If any leaks are detected, press **EMERG STOP**. Check all connections. Correct the problem and home the system.
14. Replace plastic hydropneumatics cover.
15. Slide hydropneumatics drawer back into its compartment. Close compartment door.
16. Press **MASTER SCREEN** to return to the MASTER Screen.

4.4 CIRCUIT BOARD REPLACEMENT

NOTE

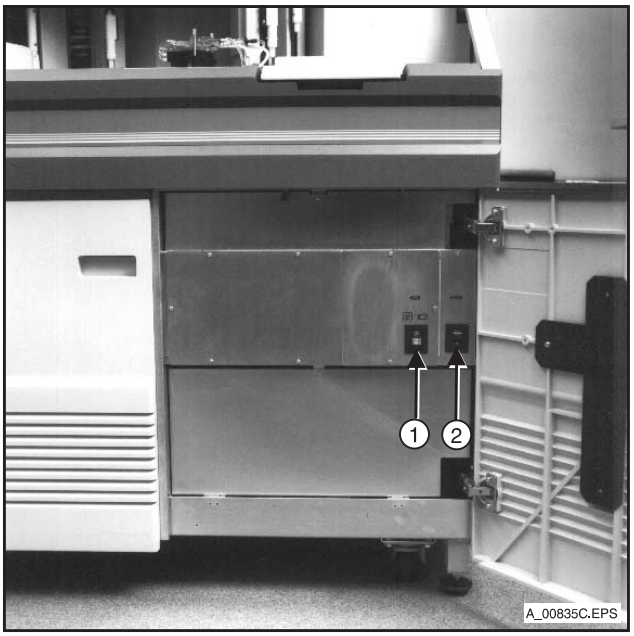
If replacing the CPU or Heater Control Boards, refer to the special instructions in **NOTE** following Step 13.

ALWAYS HANDLE CIRCUIT BOARDS BY THE EDGES ONLY. To avoid board damage due to static electricity, do not remove inner plastic wrapper from new circuit board until just before installation. Be sure wrist strap is attached to operator's arm PRIOR to removing a board.

1. From the MASTER Screen, press **SYS IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"
2. Press **Y** then **ENTER**. The screen will display:

   "SYSTEM IDLE" "CX3/ISE: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?"
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn off CX Instrument and/or PC Console Power Now."
   (a) Turn the PC console power OFF using the switch located on the front of the console unit.
7. Press MAIN power switch located behind the right front panel of the lower compartment to OFF position (Figure 4-13). Leave AUX power switch ON. The green power switch light will go out. Close cabinet door.



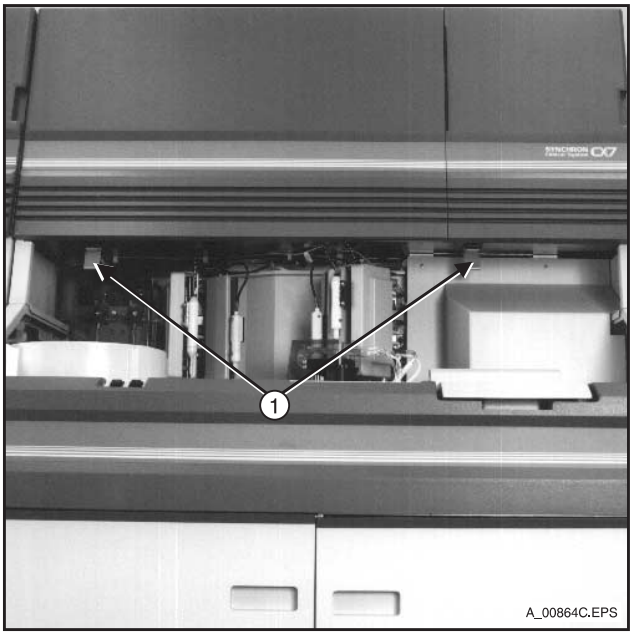
1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-13. Power Switches

8. To obtain access to electronics compartment:

4.4.1 CX4, CX5, and MAIN CX7 COMPARTMENT

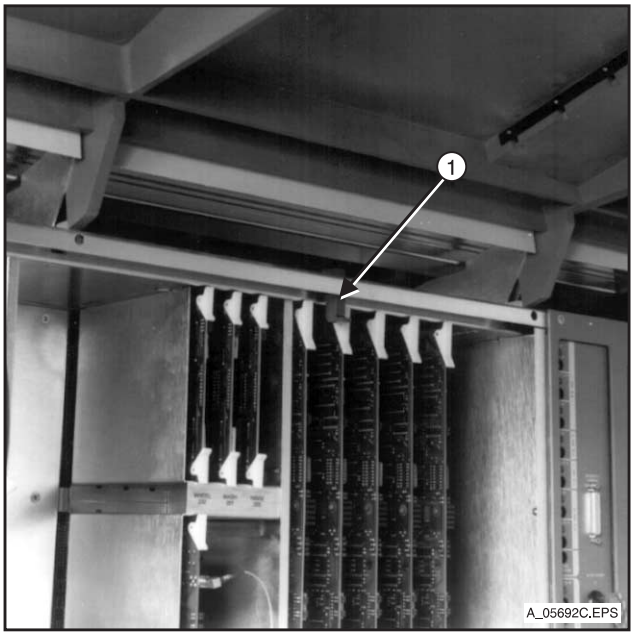
(a) Pull down, then forward to release both lid latches located under front of main compartment cover (Figure 4-14).



1 - Lid Latches (Electronics Compartment Cover)

Figure 4-14. Electronic Compartment Cover

(b) Lift cover upward until lid support latch locks (Figure 4-15). After support latch locks, slowly lower cover until it is supported by the latch mechanism. The cover will be supported approximately parallel with the top plane of the instrument.



1 - Latch Lever

Figure 4-15. Support Latch Lever

CAUTION

Do not place anything on the compartment cover while it is in the open position. Do not lean on or put pressure on the cover while it is in the open position.

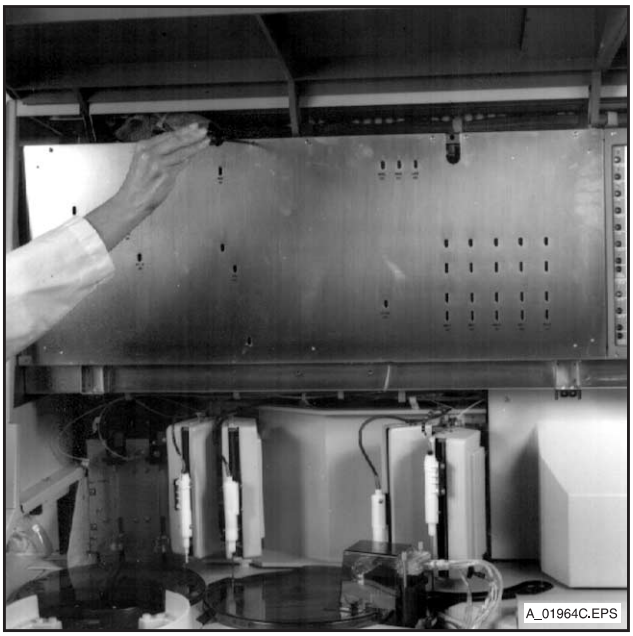
(c) Remove the metal card-cage cover:

i. Remove the 7 Phillips screws holding the cover in place (Figure 4-16A);

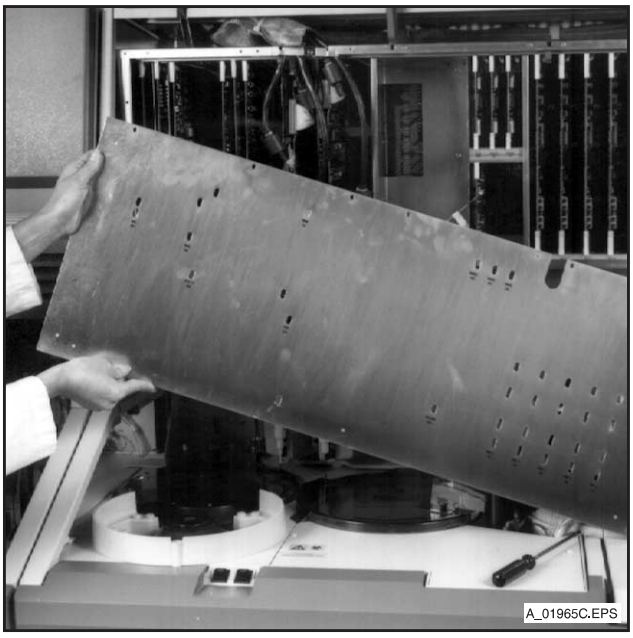
ii. Lift cover up and out (Figure 4-16B).

(d) The main electronics compartment circuit boards may now be accessed.

(e) Proceed to Step 9.



A. Remove Screws Holding Cover

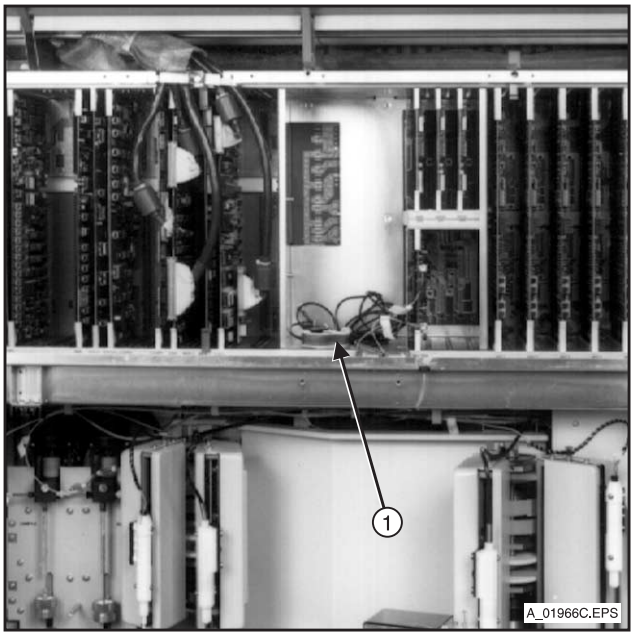


B. Lift Cover Up and Out

Figure 4-16. Removing Metal Card-Cage Cover

CAUTION

To prevent damage due to static electrical discharge, be sure wrist strap is attached to operator's arm PRIOR to removing a board (Figure 4-17).



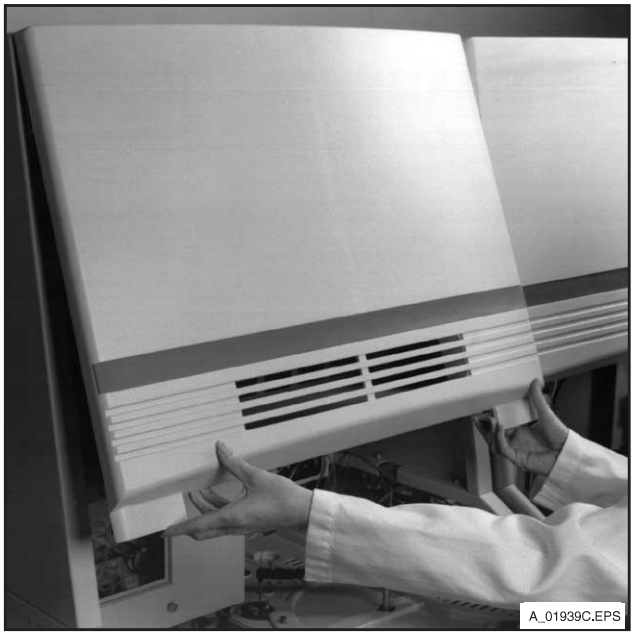
1 - Wrist Strap

Figure 4-17. Location of Wrist Strap

4.4.2 CX3 COMPARTMENT (CX7 users only)

(a) Pull down, then forward to release both lid latches on a CX7 DELTA, then lift up compartment door. (Figure 4-18A). To remove cover from a non CX7 DELTA electronics compartment,

(b) Unscrew the two captive thumbscrews located behind the lower edge of the CX3 electronics circuit board compartment (Figure 4-18B).



A

Figure 4-18. Opening CX3 Electronics Compartment Door (CX7 DELTA System)

NOTE

The cover is not hinged. It comes completely off the instrument for a CX7.

(c) With one hand pulling out from the bottom of the electronics cover, carefully lift cover up and off the instrument. Set cover aside.

B

1 - Captive Thumbscrews

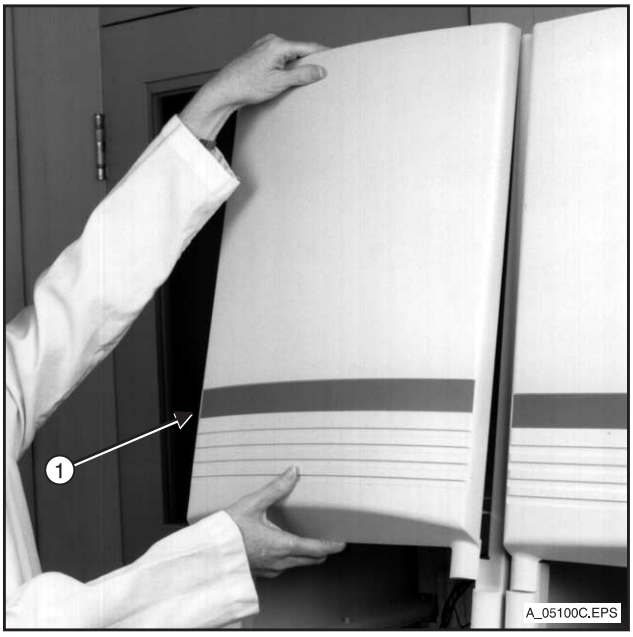
Figure 4-18. CX3 Electronics Compartment Cover (non CX7 DELTA System)

CAUTION

To prevent damage due to static electrical discharge, be sure wrist strap is attached to operator's arm PRIOR to removing a board.

4.4.3 ISE MODULE COMPARTMENT (CX5 users only)

(a) Hold the top of the cover with one hand while pulling out from the bottom. Continue pulling from bottom until bottom latch is free. (Figure 4-19).



1 - Pull Out From Bottom

Figure 4-19. Removing ISE Electronics Compartment Cover

NOTE

The cover is not hinged. It comes completely off the instrument.

(b) After bottom latch is free, lift cover up and remove. Set cover aside.

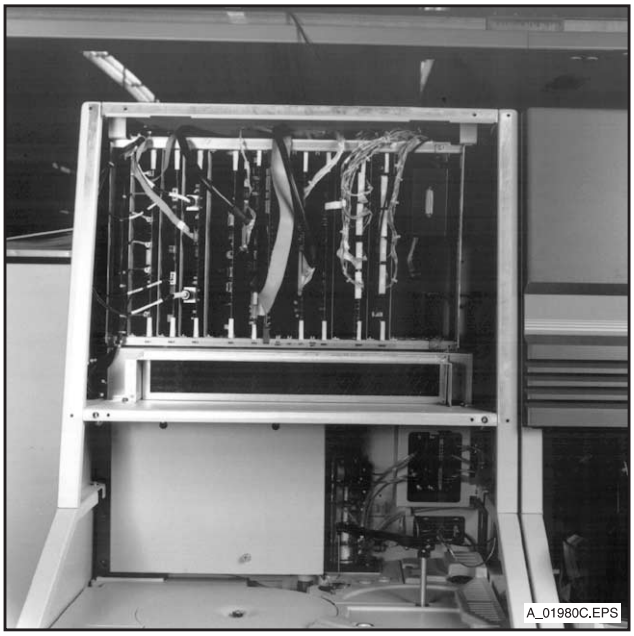
(c) Remove the 10 Phillips screws holding the metal cover to the face of the card cage. When removing the last few screws, support the cover to prevent it from falling into the ISE compartment.

(d) ISE module circuit boards may now be accessed.

CAUTION

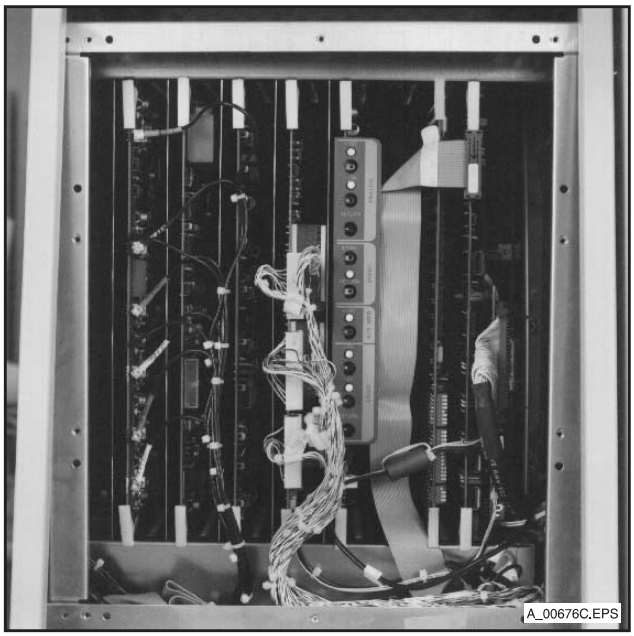
To prevent damage due to static electrical discharge, be sure wrist strap is attached to operator's arm PRIOR to removing a board.

9. Locate board that is to be replaced (Figure 4-20A or 4-20B).



A

Figure 4-20. CX3 Electronics Compartment



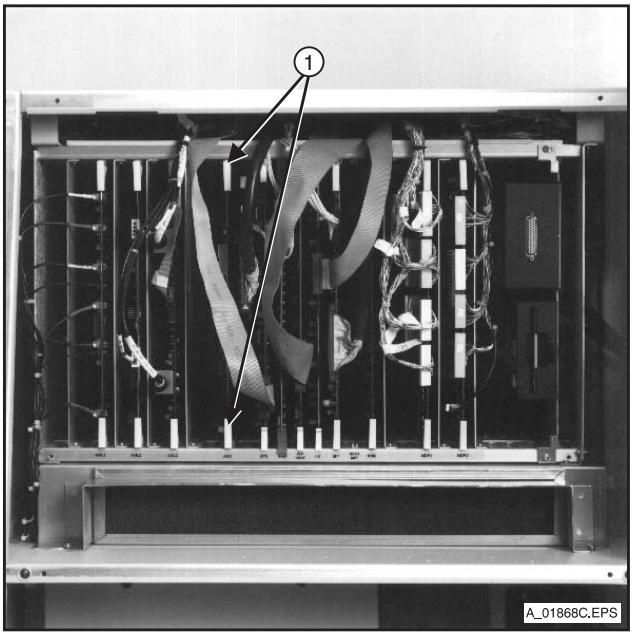
B

Figure 4-20. ISE Electronics Compartment

NOTE

To prevent damage to system, remember to note cable connector locations and orientation for proper reinstallation. All circuit boards are oriented with components on the right side.

10. Disconnect cable connections from board as necessary.
11. Use the white plastic board release levers at top and bottom of circuit board to remove the board from the electronics compartment (Figure 4-21). Note location of board.



1 - White Plastic Release Levers

Figure 4-21. Circuit Boards

12. To disconnect board from socket, pull up on the top release lever while at the same time pushing down on the lower lever (Figure 4-22). To remove board pull straight out until the board clears the plastic guide rails in top and bottom of opening.

NOTE

When removing board take care not to let the components touch any cables, wiring, etc. connected to adjacent boards.

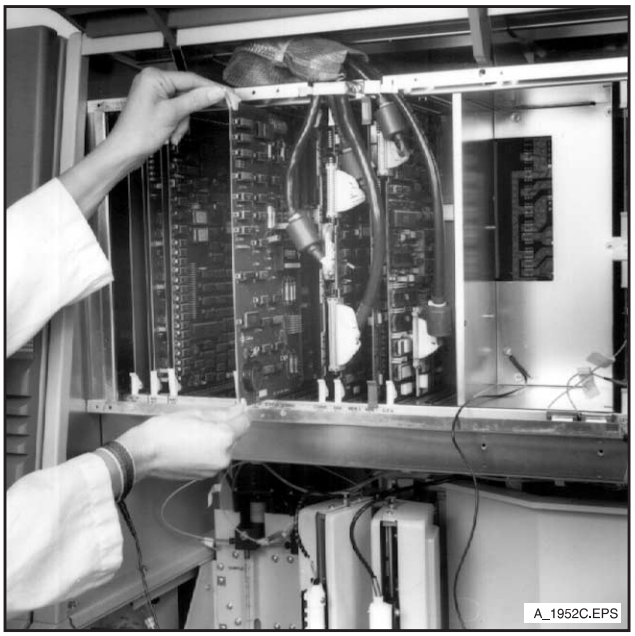


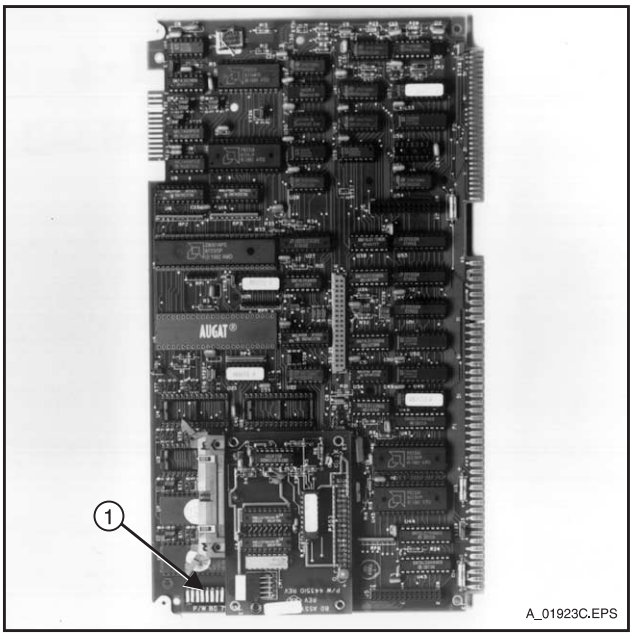
Figure 4-22. Removing Circuit Board

13. Carefully remove plastic wrapper and pin-protector strips from new board. Save wrapper and pin protectors.

NOTE

If replacing the CPU board, perform Step 10 before installing board. If replacing the memory board, perform Step 11 before replacing board. If replacing the reaction carousel heater, cuvette wash water heater, or cuvette rinse water heater boards, perform Step 12 before installing board. For all other boards, proceed to Step 17.

14. On the CPU board, switch block S1 must be configured for either CX4 or CX7/CX5 use (Figure 4-23). See Table 4-1 for switch settings.



1 - Switch Block S1

Figure 4-23. CPU Board Switch Block S1

Table 4-1. CPU Board Switch Block S1 Switch Settings for 60 Hz (for 50 Hz, S1-8 = OFF)

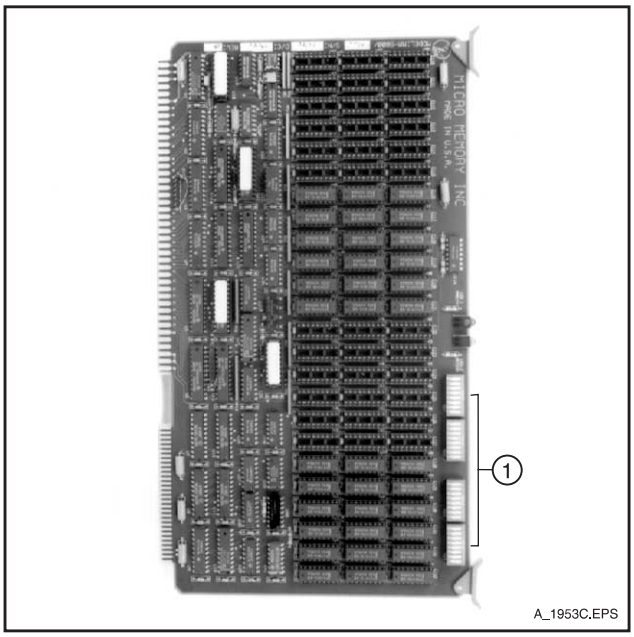
Switch Settings	CX4	ISE	CX3
S1-1	OFF	OFF	OFF
S1-2	OFF	OFF	OFF
S1-3	OFF	ON	ON
S1-4	OFF	ON	ON
S1-5	OFF	ON	ON
S1-6	OFF	ON	ON
S1-7	OFF	ON*	ON*
S1-8	ON	ON	ON

* S1-7 switch settings for reference only, not required for system operation.
CO2 enabled = ON. CO2 disabled = OFF.

15. On the memory board, verify that the switch block is set correctly (Figure 4-24). The same settings apply for a CX4, CX5, or CX7.

NOTE

Depending on type of memory board, there will be 3 or 4 switch blocks. If your board has 3 switch blocks (1 at top corner, 2 at bottom corner), see Table 4-2 for settings. If your board has 4 switch blocks, see Table 4-3 for settings.



1 - Switch Blocks

Figure 4-24. Memory Board Switch Blocks

Table 4-2. Memory Board Switch Block Settings (for Boards with 3 Switch Blocks)

C = CLOSED O = OPEN

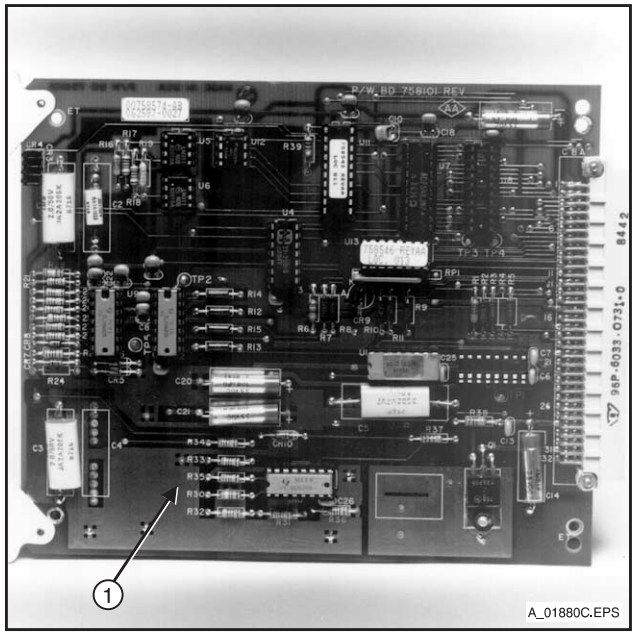
Switch Settings	SW1	SW2	SW3
S1	C	O	O
S2	C	O	O
S3	O	C	C
S4	O	O	O
S5	O	O	O
S6	O	O	O
S7	O	O	O
S8	O	O	O

Table 4-3. Memory Board Switch Block Settings (for Boards with 4 Switch Blocks)

C = CLOSED O = OPEN

Switch Settings	SW1	SW2	SW3	SW4
S1	C	O	O	C
S2	O	O	O	O
S3	O	O	O	O
S4	O	O	O	O
S5	O	O	O	O
S6	O	O	O	O
S7	O	O	C	O
S8	O	O	O	O

16. Reaction carousel heater, cuvette wash water heater, and cuvette rinse water heater boards have an individual eight-digit temperature number that must be changed in instrument memory whenever they are replaced. Record the number which is located on the board for input after board replacement (Figure 4-25).



1 - Temperature Number

Figure 4-25. Heater Board

17. If a reaction carousel heater board, cuvette wash water heater board, or cuvette rinse water heater board has been replaced, refer to the following diagnostic procedures to change the heater calibration number:

    Reaction Carousel Heater Board: Diagnostic Procedure 3.4.2.2

    Cuvette Wash Water Heater Board: Diagnostic Procedure 3.4.3.2

    Cuvette Rinse Water Heater Board: Diagnostic Procedure 3.4.4.2

NOTE

The correct calibration number must be entered to ensure proper heater operation.

18. Orient new board (with the components on the right-hand side of circuit board) and insert the top and bottom edges of board into the plastic guides in top and bottom of opening. Be sure to install replacement board in same location.

19. Using the release levers, push the board until pin connectors at inner edge of board touch the socket. Flip both release levers against the outer edge of the board. Press hard on white plastic board releases with thumbs until board snaps into place (Figure 4-26).

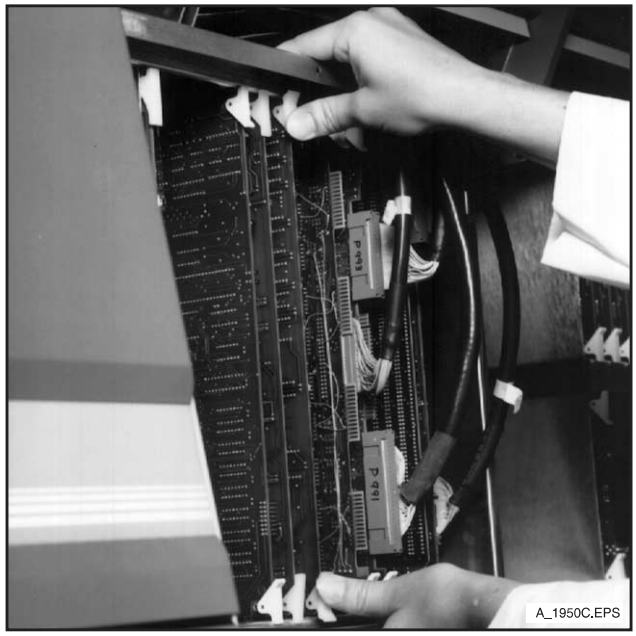


Figure 4-26. Reseating Board

NOTE

Motor control, heater and level sense boards have edge connectors that make contact gradually. They do not snap into place as do the other boards.

If inner board edge does not easily enter connector, gently press on side of board to straighten any slight bow that may be present. Use caution as some components may be sharp.

20. Gently pull on board to ensure it is seated in the socket.
21. Place pin protectors on defective board and place in plastic wrapper. Set aside for final packing and return to Beckman.
22. Reinstall all cable connections as required on front of new board. Check for proper cable connection orientation. Push cables in until snug.
23. Remove the wrist strap.
24. Replace the metal card-cage cover:
    (a) Slide the slot on the back of the cover over the front lip of the card-cage face and align it to the face of the card cage.
    (b) Replace the 7 Phillips screws firmly, attaching the card-cage cover to the system.
25. Close (install) electronics compartment cover.

4.4.4 CX4, CX5, AND MAIN CX7 COMPARTMENT COVER

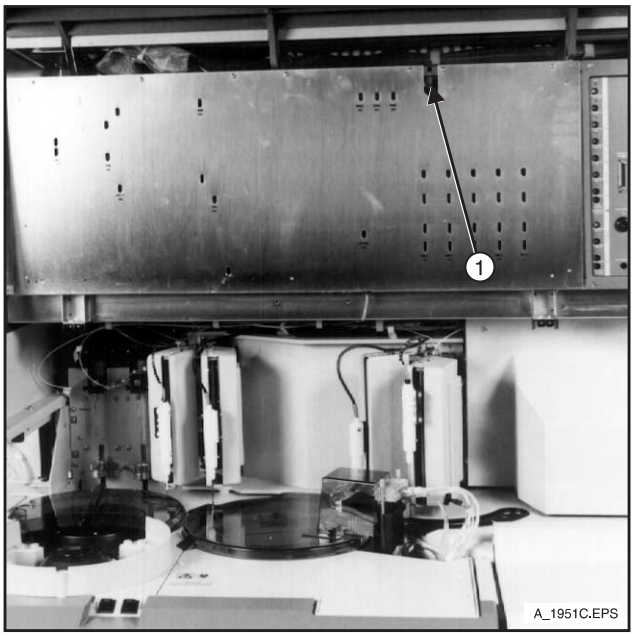
(a) Push cover up slightly and HOLD up.

(b) While supporting the cover, push down on the support latch lever and hold (Figure 4-27).

(c) Slowly lower cover while holding support latch down. Release support latch after the cover gets below locking position. Continue to lower cover slowly to normal closed position.

(d) Lock cover in place with two lid latches.

(e) Proceed to Step 26.



1 - Support Latch Lever

Figure 4-27. Closing Main Compartment Cover

4.4.5 CX3 ELECTRONICS COMPARTMENT (CX7 users only)

(a) Close door and secure lid latches for a CX7 DELTA (Figure 4-28). For non CX7 DELTA systems,

(b) Grasp cover at top and bottom.

(c) Engage top edge of cover in mounting channel. Ensure top and left side of cover are even with instrument.

(d) Hold top of cover in place while gently lowering bottom against the instrument.

(e) Tighten two captive thumbscrews located behind the lower edge of the cover.

(f) Proceed to Step 26.

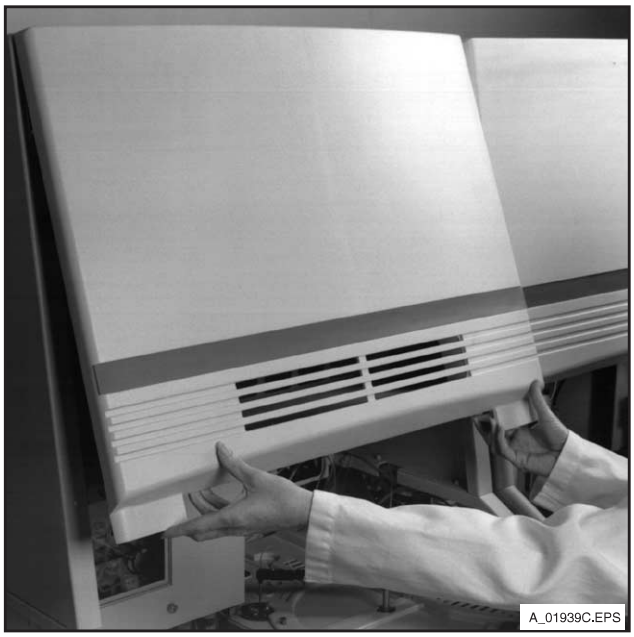


Figure 4-28. Closing CX3 Electronics Compartment Door (CX7 DELTA System)

4.4.6 ISE MODULE COMPARTMENT (CX5 users only)

(a) Align the metal card-cage cover to the face of the ISE card cage.

(b) Replace the 10 Phillips screws firmly attaching the card-cage cover to the system.

(c) Grasp cover at top and bottom.

(d) Engage top edge of cover in mounting channel. Ensure top and left side of cover are even with instrument.

(e) Hold top of cover in place while pushing in on bottom to engage cover latch.

26. Open right-hand cabinet door. Press main power switch to ON position. Green main power switch light will now be ON. Close cabinet door.

    (a) Turn the PC console ON using the switch on the front of the console unit.

27. Verify that board replacement corrected problem.

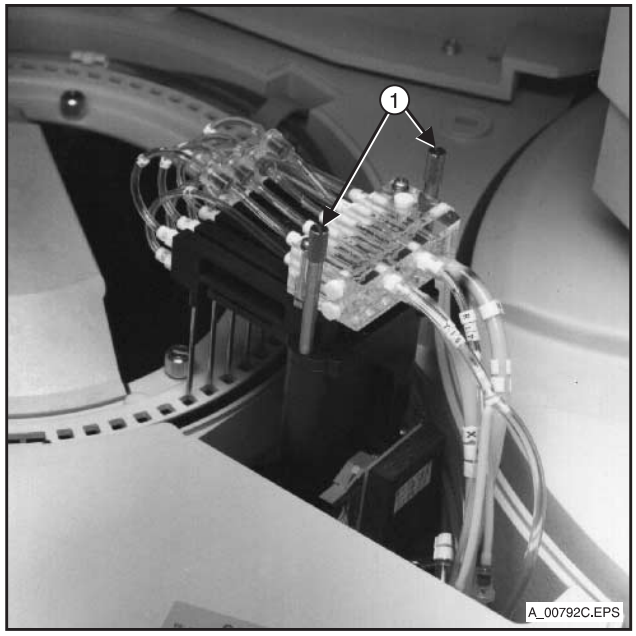
28. Pack defective circuit board for return. Ensure board is first put in plastic wrapper.

4.5 CUVETTE REPLACEMENT

1. From the MASTER Screen, press **SYS HOME**.
2. After the system homes press **SYS IDLE**. The screen will prompt: "Continue with shut down procedure (Y/N)?"
3. Press **Y** then **ENTER**. The screen will display:

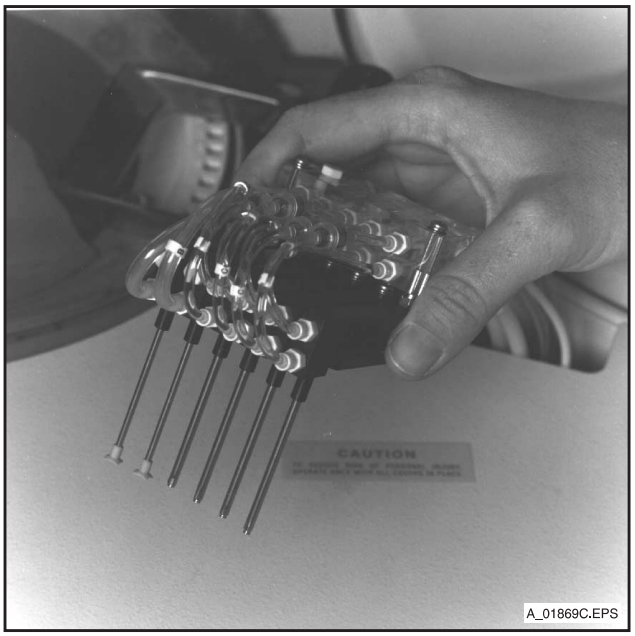
   "SYSTEM IDLE" "CX3/ISE: STANDBY"
   "CONSOLE: " "CX4: IDLE"

4. Remove reaction wheel cover.
5. Remove slotted thumbscrews to release cuvette wash station (Figure 4-29A). Lift up unit and set aside (Figure 4-29B).



A. Slotted Thumbscrews

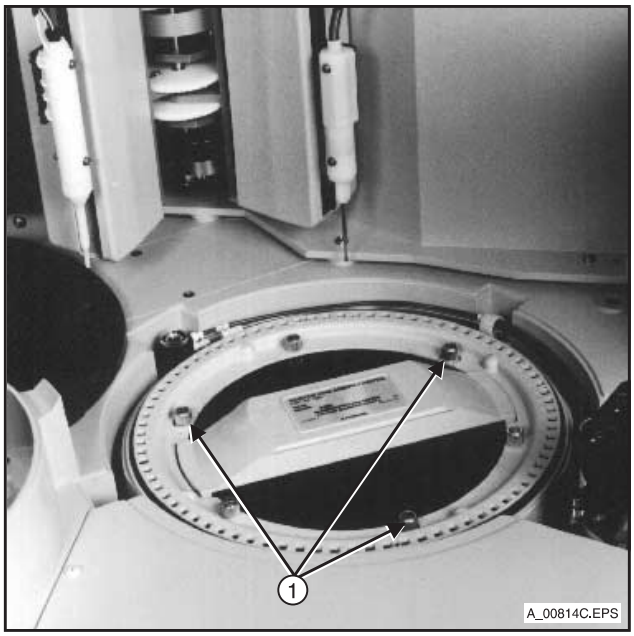
Figure 4-29. Cuvette Wash Station



B. Lift Wash Unit

Figure 4-29. Cuvette Wash Station

6. Loosen the three captive recessed thumbscrews adjacent to cuvette numbers 8, 34, and 61 (Figure 4-30). Partially loosen the three thumbscrews adjacent to cuvette numbers 21, 48, and 74.



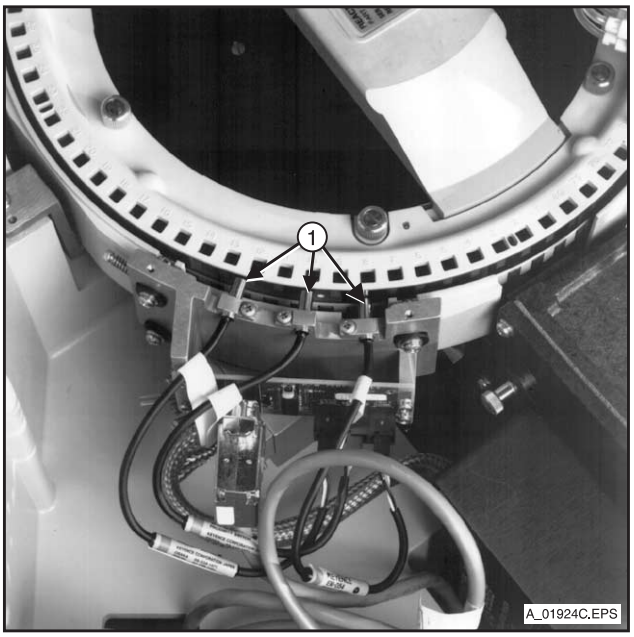
1 - Thumbscrews

Figure 4-30. Recessed Thumbscrews Adjacent to Cuvettes #8, #34, #61

NOTE

When replacing a dirty cuvette that is NOT broken, it is not necessary to remove the reaction carousel assembly. Proceed directly to Step 13.

7. Carefully lift the reaction carousel assembly, paying particular attention not to move the three carousel sensors located to the front of the reaction well (Figure 4-31 A and B). If accidentally moved, sensor realignment may be necessary. (Refer to Paragraph 3.7.4, Reaction Carousel Alignment, Step 4, j through v.)



1 - Reaction Carousel Sensors

A. Reaction Carousel Sensors

Figure 4-31. Removing Reaction Carousel Assembly

B. Lift Carousel Assembly

Figure 4-31. Removing Reaction Carousel Assembly

8. Place assembly on flat surface.
9. Completely loosen the three captive thumbscrews on top of the cuvette retaining ring. These screws are next to cuvette numbers 21, 48, and 74 (Figure 4-32).

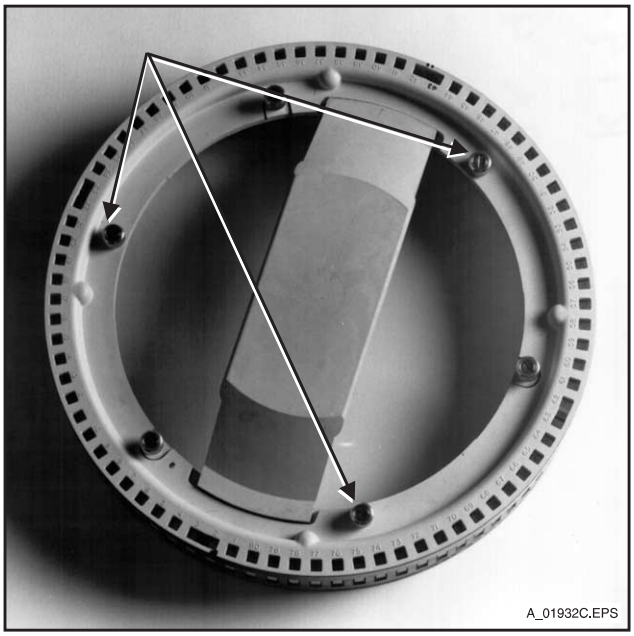


Figure 4-32. Captive Thumbscrews on Retaining Ring

10. Remove cuvette retaining ring and place on a flat surface.
11. Inspect carousel assembly for damaged cuvettes. Remove all glass fragments and fluid from the carousel drip tray.

NOTE

Do not wash glass and/or fluid down the drain trough due to possible obstruction of the sump pump. Lift out glass and wipe up any fluid following decontamination and biohazard precautions.

12. Thoroughly dry cuvette wells with a cotton-tipped applicator wrapped with a lint-free tissue. Assure that:
    (a) monochrometer lens is clean and dry
    (b) cuvette wash probes, sample and reagent probes and mixers are not bent or scratched
    (c) cuvette wash wipers are not torn or damaged.
13. Replace cuvettes noting proper orientation of cuvette placement (Figure 4-33).

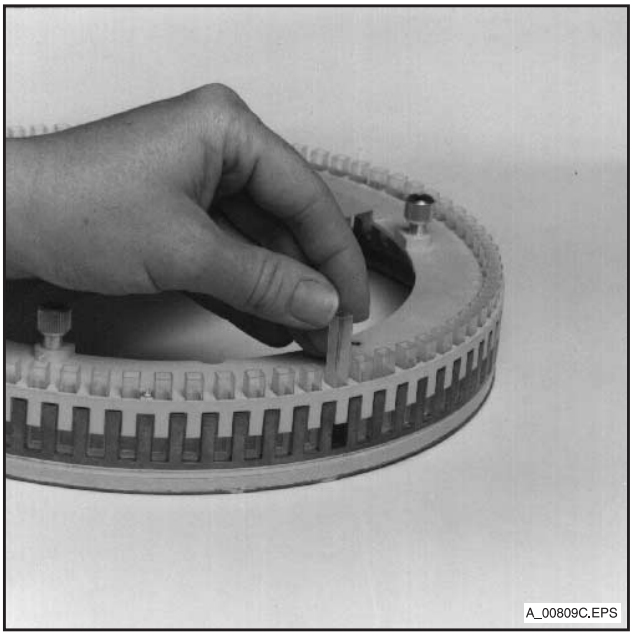
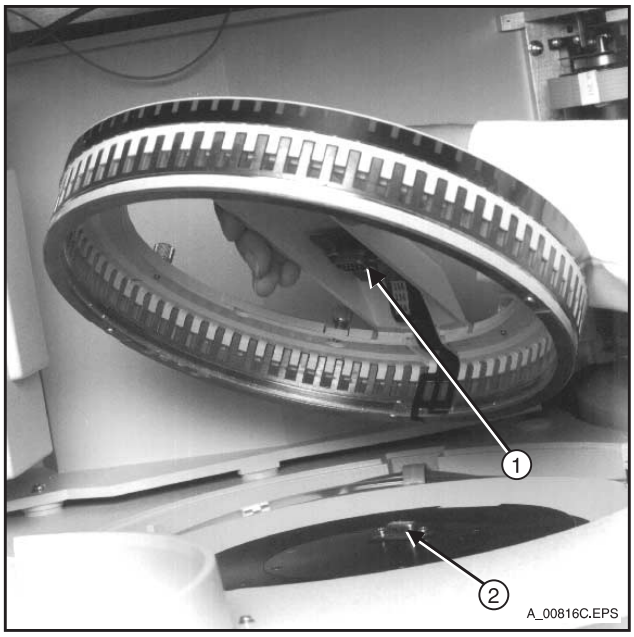


Figure 4-33. Replacing Cuvettes

NOTE

Handle cuvettes by frosted sides only. If reaction carousel assembly was not removed, proceed directly to Step 17.

14. Reinstall cuvette retaining ring. Partially tighten the three thumbscrews at cuvette numbers 21, 48, and 74.
15. Position reaction carousel assembly so that the 9-pin connector on the underside of the assembly lines up with its receptacle (Figure 4-34).



1 - 9-Pin Connector
2 - Receptacle

Figure 4-34. Line Up 9-Pin Connector to Receptacle

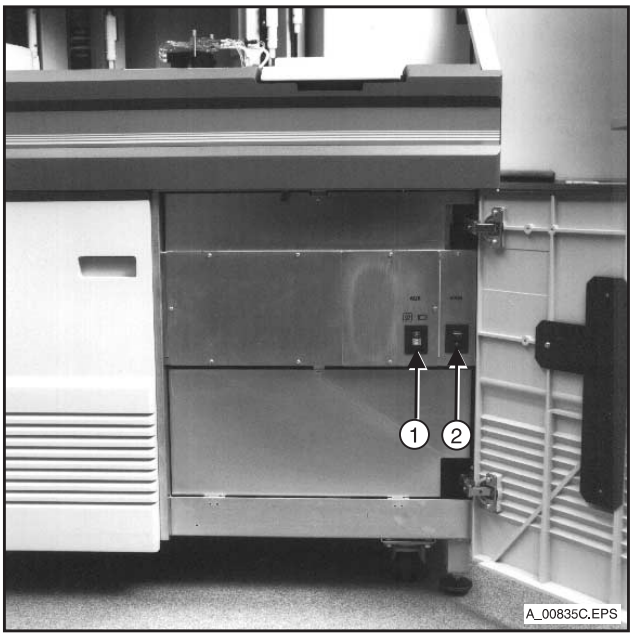
16. Gently lower carousel assembly into position.
17. Finger-tighten thumbscrews on cuvette retaining ring.
18. Finger-tighten thumbscrews on reaction carousel assembly if it was removed.
19. Replace reaction carousel cover.
20. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?"
21. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
22. Press **PREV SCREEN**. A window will pop up giving the three boot options.
23. If you are going to proceed with the Reaction Carousel Alignment Procedure select **3** to boot directly into diagnostics, otherwise press **2** and the system will reboot to the Master Screen.

4.6 DRAIN PUMP REPLACEMENT

1. From the MASTER Screen, press SYS IDLE. The screen will prompt: "Continue with the shut down procedure (Y/N)?"
2. Press **Y**. The screen will display:

   "SYSTEM IDLE" "CX3/ISE: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

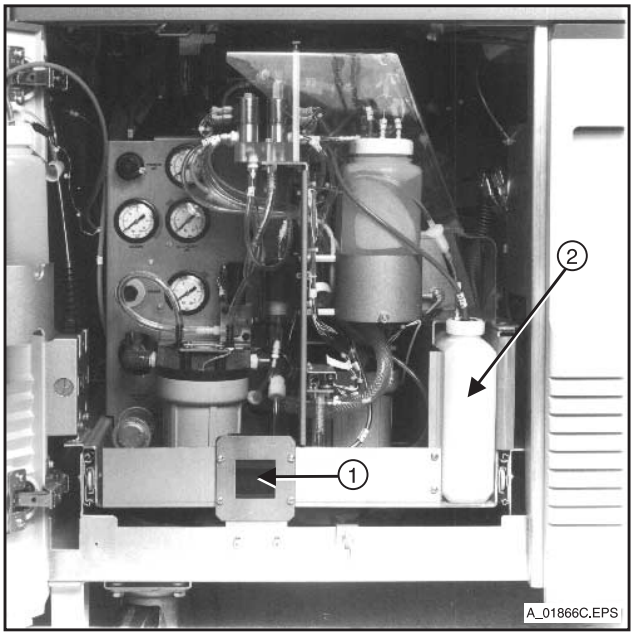
3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure?"
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn off CX Instrument and/or PC Console Power Now."
   (a) Turn the PC console power OFF using the switch on the front of the console unit.
7. Press **MAIN** power switch located behind the right front panel of the lower compartment to OFF (Figure 4-35). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-35. Power Switch

8. Open the left-hand door of the compartment.
9. Release the latch on the bottom of the hydropneumatics drawer (Figure 4-36). Pull the drawer out to its fullest extension.



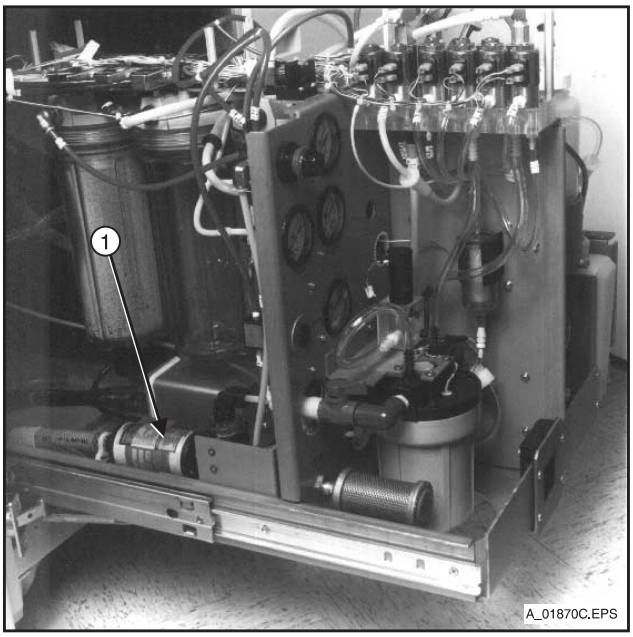
1 - Latch (Pull Up to Release)
2 - Wash Concentrate Bottle

Figure 4-36. Hydropneumatics Drawer

CAUTION

The drain pump removes potentially dangerous, contaminated material from the system. Observe standard laboratory practices pertaining to the safe handling of biological hazards when performing system maintenance or repairs.

10. Locate the drain pump on the left side of the hydropneumatics drawer (Figure 4-37).



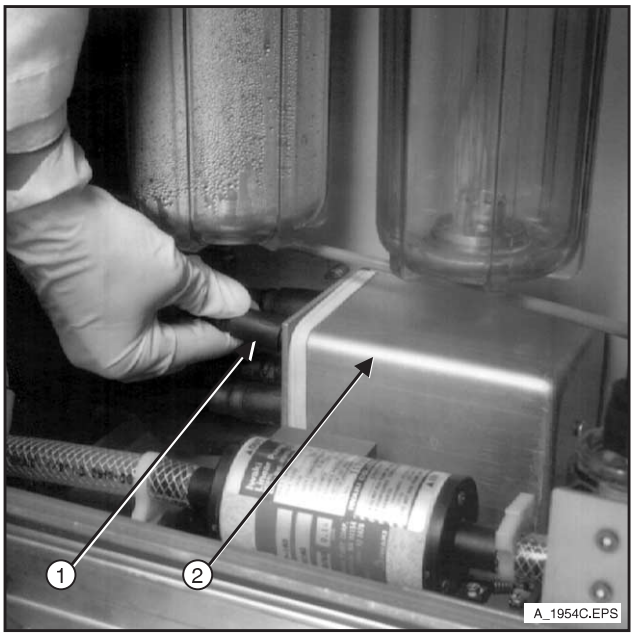
1 - Drain Pump

Figure 4-37. Locate Drain Pump

NOTE

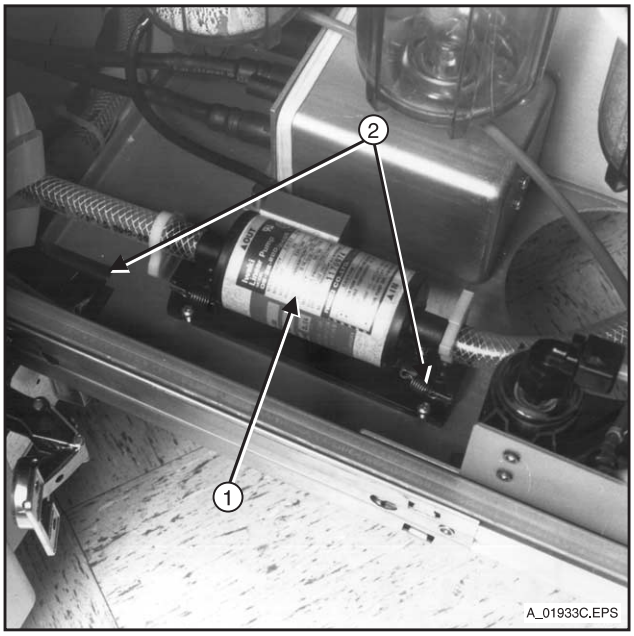
New pumps have a metal protective cover over them. This does not need to be removed when replacing the Pump.

11. Disconnect the drain pump power supply cable from the 220V interface box. Pull the plug straight back towards the rear of the instrument (Figure 4-38).
12. If a floor drain is available, empty the drain tube at the rear of the instrument by lowering the tube below instrument level.
13. Remove the screws located at each corner of the drain pump mounting bracket (Figure 4-39). Set the screws aside.



1 - Power Supply Cable
2 - 220V Interface Box

Figure 4-38. Disconnect Drain Pump Power Supply Cable



1 - Drain Pump
2 - Mounting Plate Screws

Figure 4-39. Remove Drain Pump Mounting Bracket Screws

14. Place a large-mouthed waste receptacle under the hydropneumatic drawer. Position it directly below the round hole in the floor of the drawer.

This will catch any waste overflow that may be left standing in the lines after they are removed from the pump (Figure 4-40).

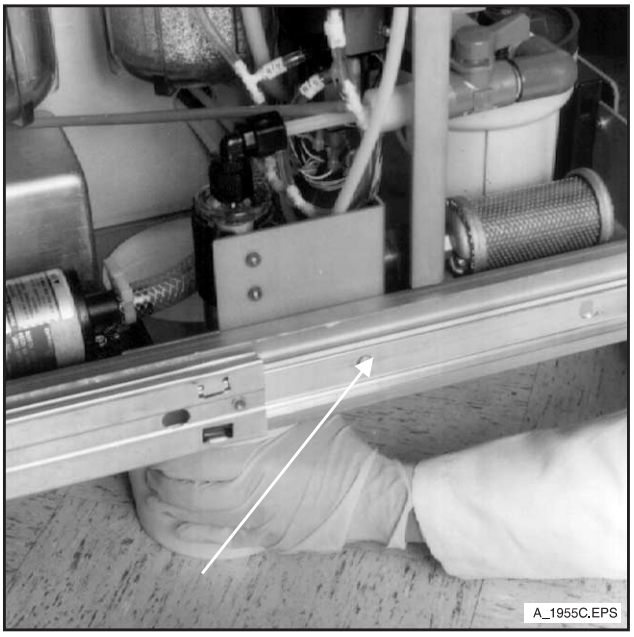
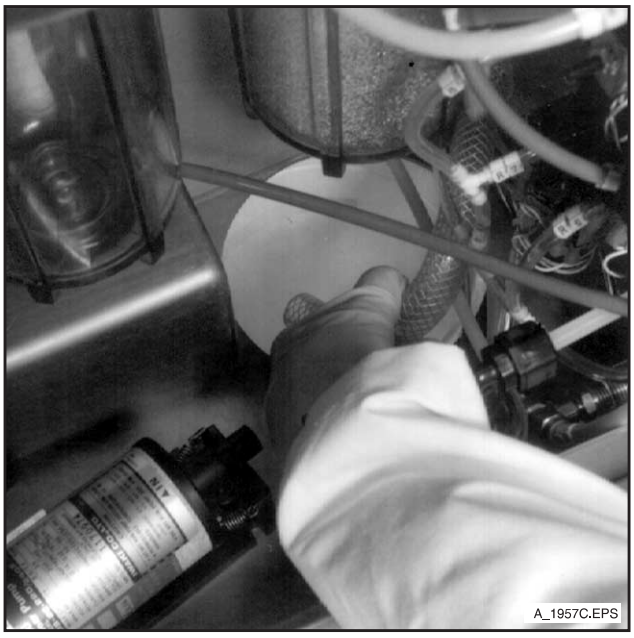


Figure 4-40. Place Waste Receptacle Under Hydropneumatic Drawer.

15. Lift the pump assembly up.
16. Twist and pull the tubing from each end of the pump to disconnect. Allow any waste left standing in the tubes to drain into the prepared container or floor drain (Figure 4-41 A and B).

A. Pull Tubing From Each End of Pump.



B. Let Tubing Drain.

Figure 4-41. Removing Drain Pump

17. Remove the drain pump.
18. Install the replacement pump. Screw in the four mounting bracket screws.

NOTE

The end of the pump labeled OUT faces the rear of instrument.

19. Connect the tube that leads out of the rear of the instrument to the OUT end of the drain pump. Connect the tube that leads to the drain pump container to the IN end of the replacement pump.

20. Connect the pump power cable to the rear of the 220V interface box.

NOTE

Orient plug so that the arrow on the plug cowling is on TOP when pushing plug into position. When properly installed, the end of the cowling should be flush with the side of the box.

21. Lift up on the metal tabs located on each side of the bottom runner of the hydropneumatic unit and slide the hydropneumatic drawer back into its compartment. Close the compartment door.

22. Open the right-hand compartment door. Turn MAIN power switch ON. The green light will go on. Close the compartment door.

23. Turn the PC console ON using the switch on the front of the console unit.

4.7 KEYBOARD REMOVAL AND REPLACEMENT

1. Unplug the keyboard connector cord from the back of the HP computer.

2. Plug the new keyboard connector cord into the circular "B" receptacle (Figure 4-42) located on the lower edge (of the back) of the HP computer.

3. The keyboard is ready for use.

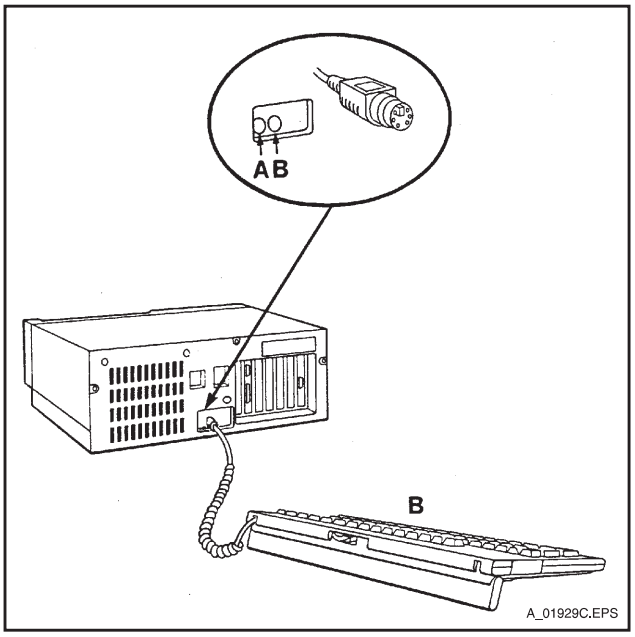


Figure 4-42. Connect the Keyboard

4.8 MONITOR REPLACEMENT

1. From the MASTER Screen, press **SYS IDLE**. The screen prompts: "Continue with the shut down procedure (Y/N)?"

2. Press **Y**. The screen will display:

"SYSTEM IDLE"	"CX3/ISE: STANDBY"
"CONSOLE: "	"CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure?"

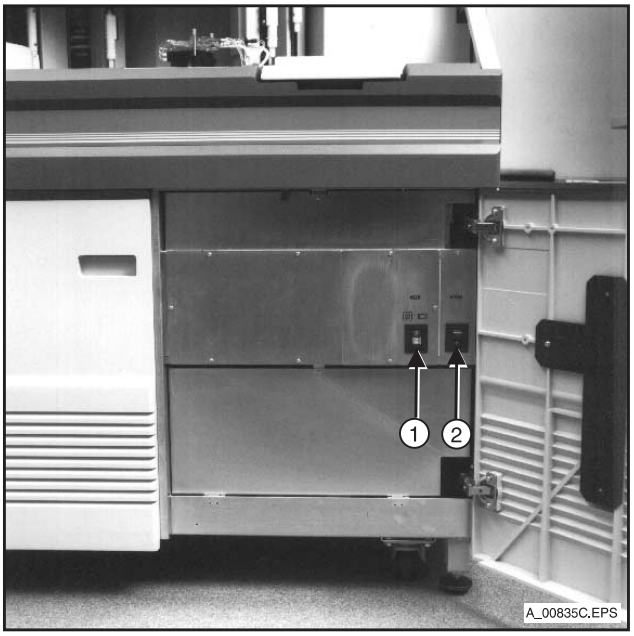
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).

5. Press **PREV SCREEN**. A window will pop up giving four boot options.

6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn off CX Instrument and/or PC Console Power Now."

(a) Turn the PC console power OFF using the switch on the front of the console unit.

7. Press **MAIN** power switch located behind the right front panel of the lower compartment to OFF position. Leave AUX power switch ON. The green power light will go out. Close compartment door (Figure 4-43).

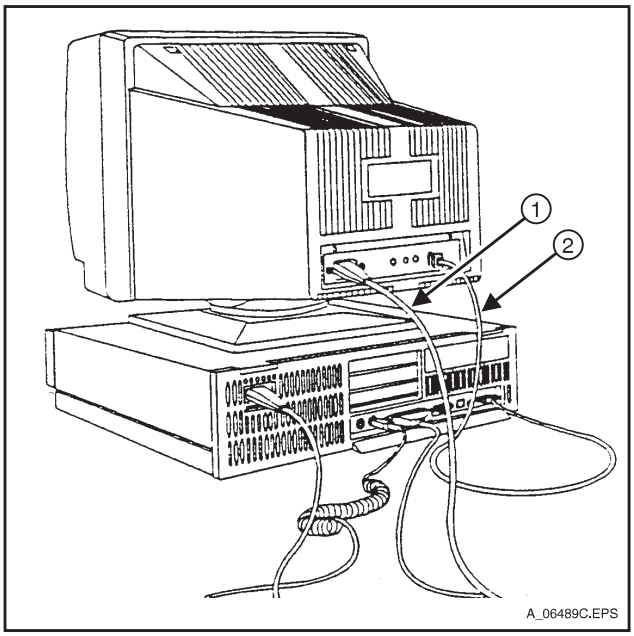


1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-43. Power Switch

8. Turn off monitor power switch. Refer to the appropriate Operating Instructions for description of possible monitor styles.

9. Disconnect display video cable from lower right side of the back of the computer (Figure 4-44).



1 - IEC Power Cord
2 - Display Video Cable

Figure 4-44. Disconnect Display Video Cable

10. Disconnect the IEC power cord that runs from the back of the monitor to the AC Output Port of the computer (Figure 4-44).

11. Remove old monitor and put new monitor into position. (Package defective monitor for return shipment.)

12. Be sure the new monitor power switch is turned off.

13. Reattach the IEC power cord to the monitor at the MAIN PORT. Reconnect the other end of the cable to the AC Output Port on the back of the computer.

14. Plug the display video cable to the back right-hand side of the computer.

15. Turn on the monitor power switch.

16. Open right-hand compartment door. Turn MAIN power switch to ON. The MAIN power switch green light will go ON. Close compartment door.

17. Turn the PC console ON using the switch on the front of the console unit.

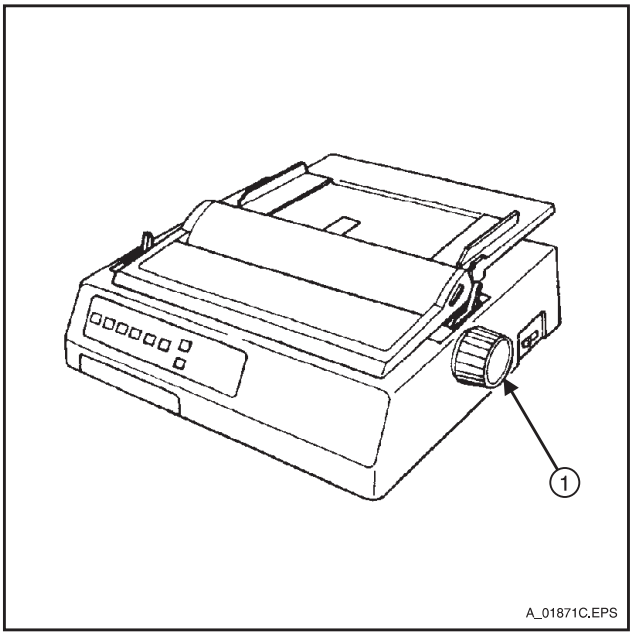
18. The monitor is ready for use, and the instrument will then complete the normal boot-up process.

4.9 PRINTER REPLACEMENT

NOTE

The system will support different models of printers. The following general directions apply for all printer models. For more specific information, refer to the printer manual that came with your system.

1. Disconnect the cable which links the printer to the instrument. This cable is plugged into the connector cable receptacle on the back of the printer and into the printer port on the lower right- hand side of the instrument.
2. Set the printer ON/OFF Switch to OFF position.
3. Disconnect printer power cord from power source located on the lower right-hand side of the instrument and from the printer.
4. Manually rewind paper from printer by turning the platen knob counterclockwise (Figure 4-45).



1 - Platen Knob

Figure 4-45. Printer

5. Install new printer.

NOTE

Be sure power switch on new printer is set to OFF position. Remove and save the retainer which secures the printhead during shipment.

6. Connect the printer power cord first to the printer, then to the power source located on the lower right-hand side of the instrument.
7. Set printer power switch to ON position.
8. Reattach the printer to instrument by connecting the printer end of the cable to the connector cable receptacle located on the back of the printer. Reconnect the other end of the cable to the printer port, located on the lower right-hand side of the instrument.
9. Load the printer paper. For instructions, refer to the printer manual that came with your system.
10. Press the **SELECT** button. The SELECT light should turn off.
11. Turn the platen knob to the desired top of form. Press the TOF SET (Top of Form Set) button on the printer.
12. Press the **SELECT** button on the printer. The SELECT light should turn on.
13. The printer is ready for use.

Table 4-4. Printer, Front Panel

POWER Light	When lit, indicates printer power is on.
ALARM Light	When lit, indicates printer is out of paper. (Also lights when printer fails memory self-test).
SELECT Light	When lit, indicates printer is ready to print data. Printer is off-line when light is out.
TOF SET*	Sets top-of-form, the location on printer paper where printer begins printing.
FORM FEED	Advances paper to next top-of-form position.
LINE FEED	Advances paper one line.

* Enabled only when SELECT light is out (i.e., printer is off line)

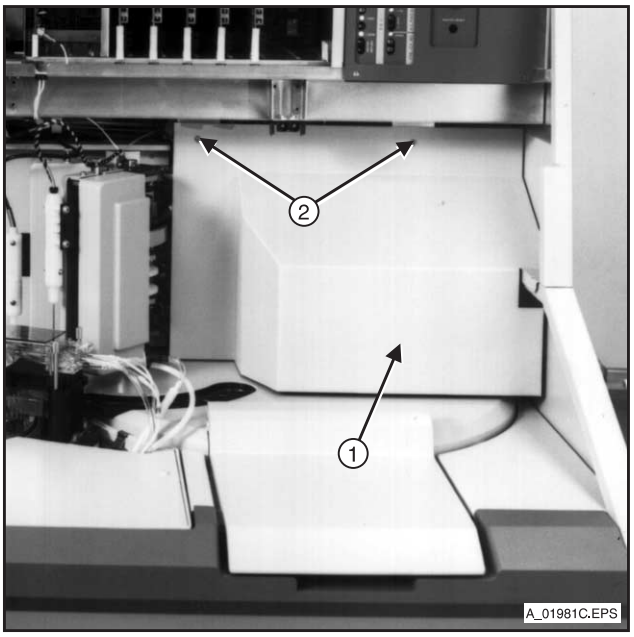
4.10 SAMPLE AND REAGENT REPLACEABLE PARTS

4.10.1 Sample/Reagent Mixer Assembly Replacement

1. Remove autoloader, and sample carousel covers.

NOTE

For Reagent Mixer Assembly replacement remove the front reagent carousel motor cover (Figure 4-46).



1 - Reagent Carousel Motor Cover
2 - Retaining Screws

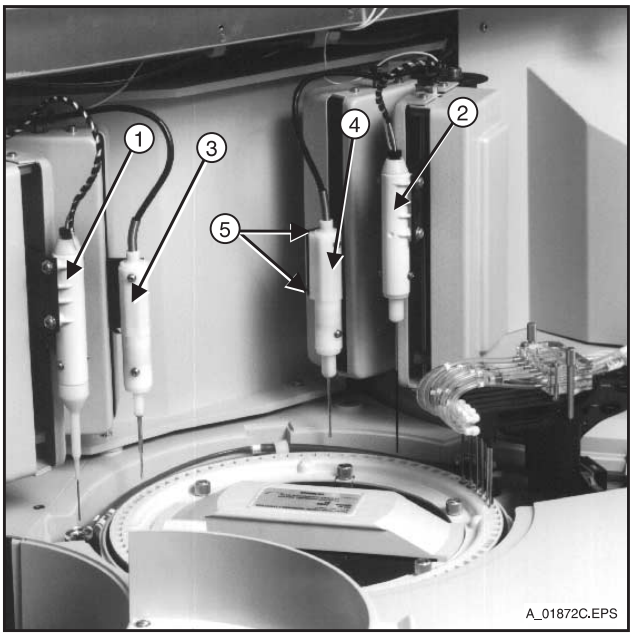
Figure 4-46. Remove Reagent Carousel Motor Cover.

2. From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
3. Cursor and **SELECT** 3. Diagnostics/Alignment or type 3 and **ENTER**.
4. Press **F4 CX4 DIAG**. If the screen prompts "Entering CX4 Diagnostics requires 5 minutes. Do you wish to continue (Y/N)?" Press **Y**.
5. From the CX4 diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to enter into ALIGNMENT Mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen. At this time proceed with either step (d) for sample mixer replacement, or step (e) for reagent mixer replacement.
   (d) For sample mixer replacement cursor and **SELECT** 5. Sample System or type 5 **ENTER**. Proceed with step (f).
   (e) For reagent mixer replacement cursor and **SELECT** 6. Reagent System or type 6 **ENTER**.
   (f) Cursor and **SELECT** 2. Mixer Rotary Alignment or type 2 **ENTER**. The screen prompts: "Continue with procedure (Y/N)?"
   (g) Press **Y**.
6. When the screen displays Procedural Steps, carefully move the probe crane assembly aside for easy access to the mixer assembly (Figure 4-47).

NOTE

Once the functional area in diagnostics is accessed, all motors to the crane assembly selected should move freely without resistance. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

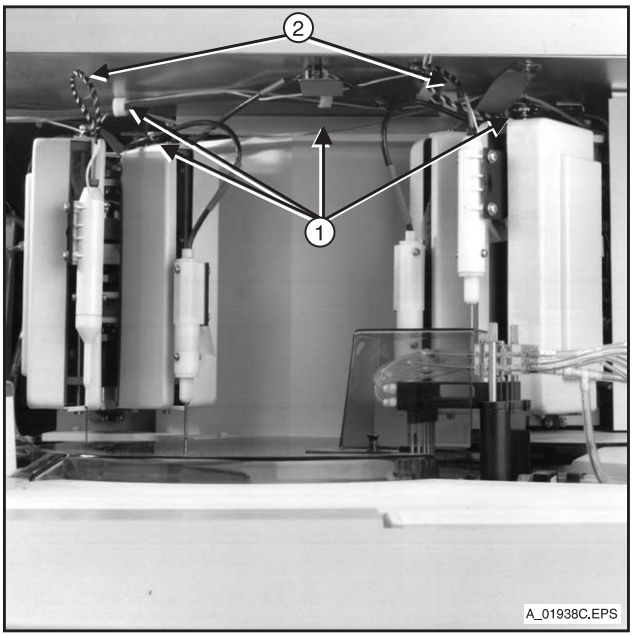
Disregard instructions on the screen at this step. Rotary alignment should not be necessary at this time.



1 - Sample Probe Assembly
2 - Reagent Probe Assembly
3 - Sample Mixer Assembly
4 - Reagent Mixer Assembly
5 - Phillips Screws

Figure 4-47. Probe and Mixer Assemblies

7. Remove the mixer assembly cable from the cable clamps (Figure 4-48).



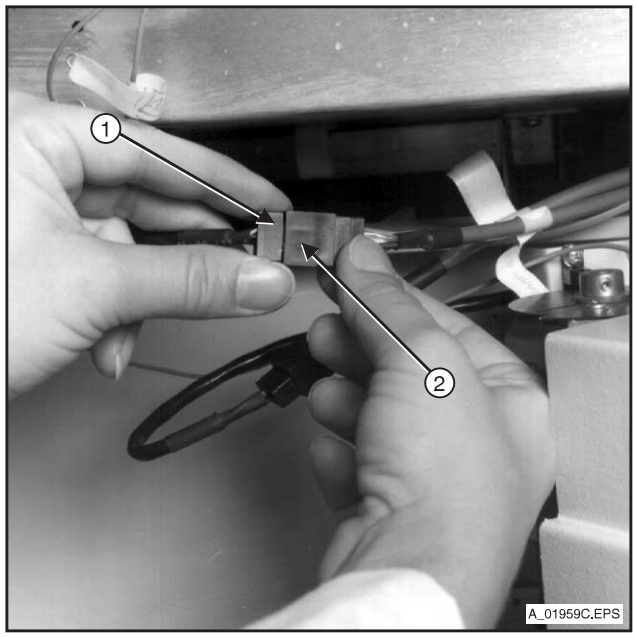
1 - Cable Clamps
2 - Level Sense Cables

Figure 4-48. Cables and Cable Clamps

8. Disconnect the mixer assembly cable by gently pulling apart the plug from the connector (Figure 4-49).

NOTE

Do not attempt to separate by pulling on cables.



1 - Mixer Cable Plug.
2 - Connector.

Figure 4-49. Separate Mixer Cable Plug from Connector

9. Position the mixer assembly for easy access to the two Phillips screws.
10. Remove the Phillips screws from the mixer mounting bracket and set aside.
11. To install the replacement mixer assembly:
    (a) Install the two Phillips screws (Figure 4-50).

NOTE

Install the Phillips screws on the mixer assembly so they are facing away from the center of the crane assembly. Install Phillips screws securely but do not tighten. It will be necessary to adjust the position of the assembly on the mounting bracket. Alignment will be described below.

(b) Connect mixer assembly cable to harness.

(c) Secure cables back into mounting clamps.

1 - Phillips screws

Figure 4-50. Installation of Mixer Assembly

12. Press **PREV SCREEN**. The screen prompts: "Exit this procedure (Y/N)?"
13. Press **Y**.
14. Press **PREV SCREEN**.
15. Press **F2 SETUP OPTIONS** to select operation mode.
16. Press **SELECT** to enter into the extended Mode.
17. Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
18. Choose the appropriate functional area (5. for Sample mixer or 6. for Reagent mixer).
19. Cursor and **SELECT** 2. Mixer or type 2 **ENTER**.
20. Press **F1 CONTINUE**.
21. When the system is ready, press **F1 ROTARY MOTOR**.
22. When the system is ready, press **ENTER** to move mixer arm over the cuvette position.
23. Press **F1 VERTICAL POWER** to relieve power to vertical motor.

CAUTION

Pressing the down arrow key releases power to the mixer crane vertical motor and allows the operator to center the mixer in the cuvette. Cuvette breakage may occur if mixer assembly is not gently lowered into cuvette.

24. Center mixer between front and rear walls of cuvette.
25. Tighten Phillips screws securely onto mixer mounting bracket. Observe that mixer remains centered in cuvette.
26. Press **ENTER** to step through mixer positions. Verify that mixer is centered in cuvette by repeating Steps 22 and 23.
27. Press **F8 DIAG MENU** to return to the diagnostics MAIN MENU Screen.
28. Press **F2 SETUP OPTIONS**.
29. Press **SELECT** to enter into the ALIGNMENT Mode.
30. Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
31. Choose the appropriate functional area. Cursor and **SELECT** 5. for Sample Mixer or 6. for Reagent Mixer.
32. Using arrow keys, toggle to 8. Mixer Height Adjustment. Press the **SELECT** key.
33. When the screen prompts: "Continue with this procedure (Y/N)?" Press **Y**.
34. Clear area around probe and mixer.
35. Press **ENTER**.
36. Manually lower mixer as far as possible.
37. Press **ENTER**.
38. Press **F8 DIAG MENU** to enter the diagnostics MAIN MENU Screen.
39. Press **PREV SCREEN** to return to the DIAGNOSTICS ENTRY Screen.
40. Press MASTER SCREEN to return to the OPERATING PROGRAM MASTER Screen.
41. Replace covers, including front reagent carousel motor cover, if necessary.

4.10.2 Sample and Reagent Mixer Paddle Replacement

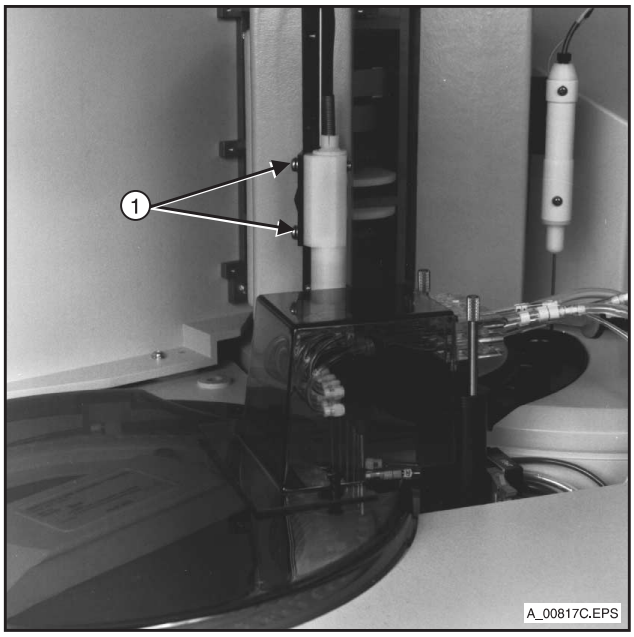
1. Remove covers.
2. From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
3. Cursor and **SELECT** 3. Diagnostics/Alignment or type 3 **ENTER**.
4. Press **F4 CX4 DIAG**. If the screen prompts "Entering CX4 Diagnostics requires 5 minutes. Do you wish to continue (Y/N)?" Press **Y**.
5. From the CX4 diagnostics MAIN MENU Screen:
   (a) Press **F2 SETUP OPTIONS** to select operation mode.
   (b) Press **SELECT** to enter into the ALIGNMENT Mode.
   (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
   (d) For sample mixer paddle replacement cursor and **SELECT** 5. Sample System or type 5 **ENTER**. Proceed with Step (f).
   (e) For reagent mixer paddle replacement cursor and **SELECT** 6. Reagent System or type 6 **ENTER**.
   (f) Cursor and **SELECT** 2. Mixer Rotary Alignment or type **2 ENTER**. The screen prompts: "Continue with procedure (Y/N)?"
   (g) Press **Y**.
6. When the screen displays Procedural Steps, carefully move the probe crane assembly aside for easy access to the mixer assembly.

NOTE

Once the functional area in diagnostics is accessed, all motors to the crane assembly selected should move freely without resistance. Should you experience any difficulties, contact the clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

Disregard instructions on the screen at this step. Rotary alignment should not be necessary at this time.

7. Thoroughly wipe the mixer paddle to be replaced using a lintless tissue soaked with 70% isopropanol.
8. Remove the two Phillips screws holding the mixer assembly to the mixer crane (Figure 4-51). Place aside.



1 - Phillips Screws

Figure 4-51. Remove Phillips Screws Holding Mixer Assembly.

9. Firmly hold the mixer assembly in one hand (Figure 4-52).

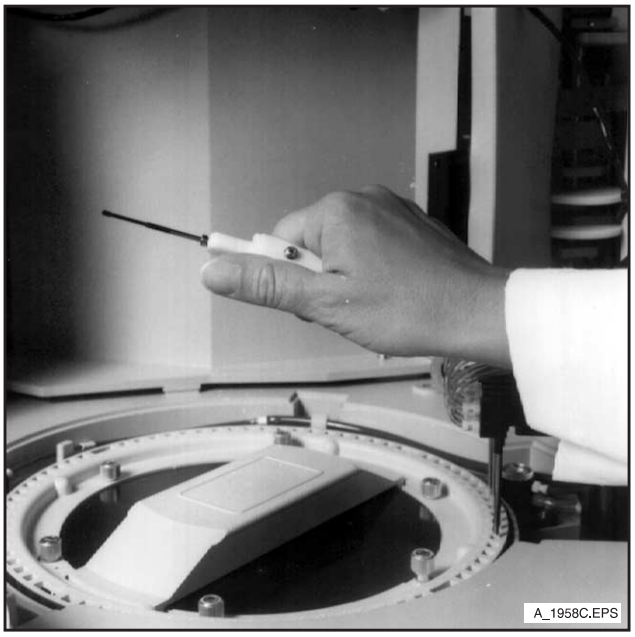


Figure 4-52. Firmly Hold Mixer Assembly.

10. Using a needle-nose pliers, grasp the bottom of the metal shaft near the collar. Be careful not to damage the gold coating on the mixer paddle (Figure 4-53).

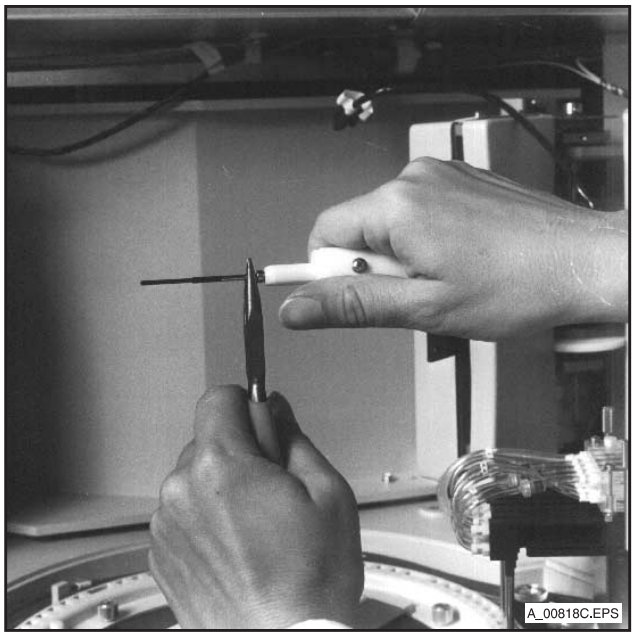


Figure 4-53. Grasp Bottom of Metal Shaft Near Collar.

11. While holding the pliers in place, separate the mixer paddle from the assembly by pressing your thumb against the pliers (Figure 4-54).

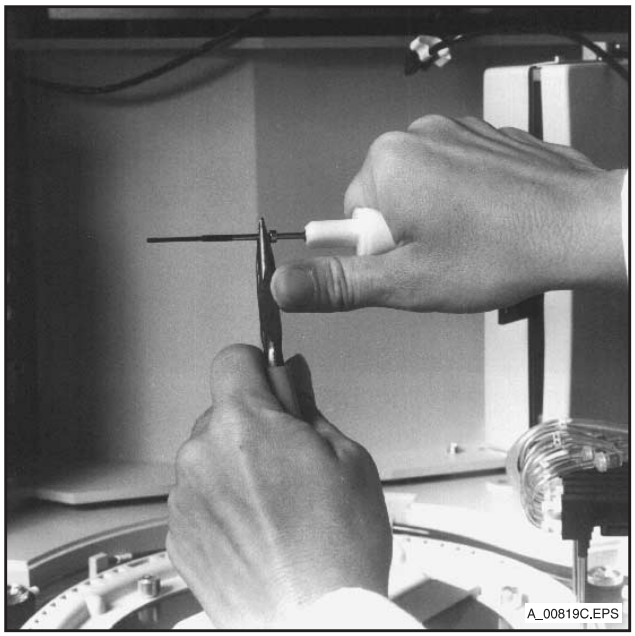


Figure 4-54. Separate Mixer Paddle from Assembly.

12. Remove the paddle, being careful not to lose bearing cup.

13. Replace with the new paddle mixer by engaging the metal shaft of the mixer into the assembly (Figure 4-55).

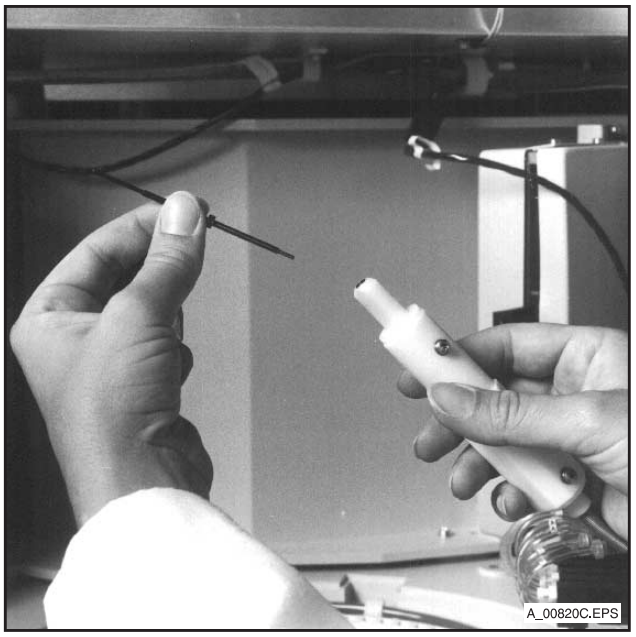


Figure 4-55. Engage Metal Shaft of Mixer Paddle into Assembly.

14. Snap into place (Figure 4-56).

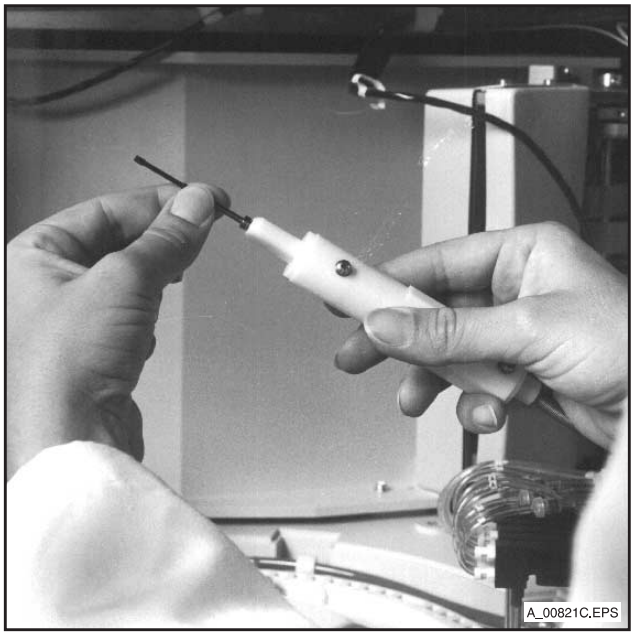


Figure 4-56. Snap Mixer Paddle into Place.

15. Reassemble the mixer assembly to the mixer crane using the two Phillips screws. Tighten.

16. Press **PREV SCREEN**. The screen prompts: "Exit this procedure (Y/N)?"

17. Press **Y**.
18. Press **PREV SCREEN**.
19. From the CX4 diagnostics MAIN MENU Screen:
    (a) Press **F2 SETUP OPTIONS** to select operation mode.
    (b) Press **SELECT** to enter into the EXTENDED Mode.
    (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
    (d) For sample mixer paddle replacement cursor and **SELECT** 5. Sample System or type 5 **ENTER**. Proceed with Step 24.
    (e) For reagent mixer paddle replacement cursor and **SELECT** 6. Reagent System or type 6 **ENTER**.
    (f) Cursor and **SELECT** 2. Mixer Rotary Alignment or type 2 **ENTER**. The screen prompts: "Continue with procedure (Y/N)?"
    (g) Press **Y**.
20. Press **F1 CONTINUE**.
21. When the system is ready, press **F1 ROTARY MOTOR**.
22. When the system is ready, press **ENTER** to move mixer arm over the cuvette position.
23. Press **F1 VERTICAL POWER** to relieve power to vertical motor.

CAUTION

Pressing the down arrow key releases power to the mixer crane vertical motor and allows the operator to center the mixer in the cuvette. Cuvette breakage may occur if mixer assembly is not gently lowered into cuvette.

24. Center mixer between front and rear walls of cuvette.
25. Tighten Phillips screws securely onto mixer mounting bracket. Observe that mixer remains centered in cuvette.
26. Press **ENTER** to step through mixer positions. Verify that mixer is centered in cuvette by repeating Steps 22 and 23.
27. Press **F8 DIAG MENU** to return to the diagnostics MAIN MENU Screen.
28. Press **F2 SETUP OPTIONS**.
29. Press **SELECT** to enter into the ALIGNMENT Mode.
30. Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
31. For sample mixer paddle replacement cursor and **SELECT** 5. Sample System or type 5 **ENTER**. Proceed with Step 33.
32. For reagent mixer paddle replacement cursor and **SELECT** 6. Reagent System or type 6 **ENTER**.
33. Cursor and **SELECT** 8. Mixer Height Adjustment or type **8 ENTER**.
34. When the screen prompts: "Continue with this procedure (Y/N)?" Press **Y**.
35. Clear area around probe and mixer.
36. Press **ENTER**.
37. Manually lower mixer as far as possible.
38. Press **ENTER**.
39. Press **F8 DIAG MENU** to enter the diagnostics MAIN MENU Screen.
40. Press **PREV SCREEN** to return to the DIAGNOSTICS ENTRY Screen.
41. Press **MASTER SCREEN** to return to the OPERATING PROGRAM MASTER Screen.
42. Replace covers.

4.10.3 Sample/Reagent Probe Assembly Replacement

4.10.3.1 Sample/Reagent Probe Assembly Replacement (Original Probes)

1. From the MASTER Screen, press **SYSTEM IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"
2. Press **Y**, then **ENTER**. The screen will display:

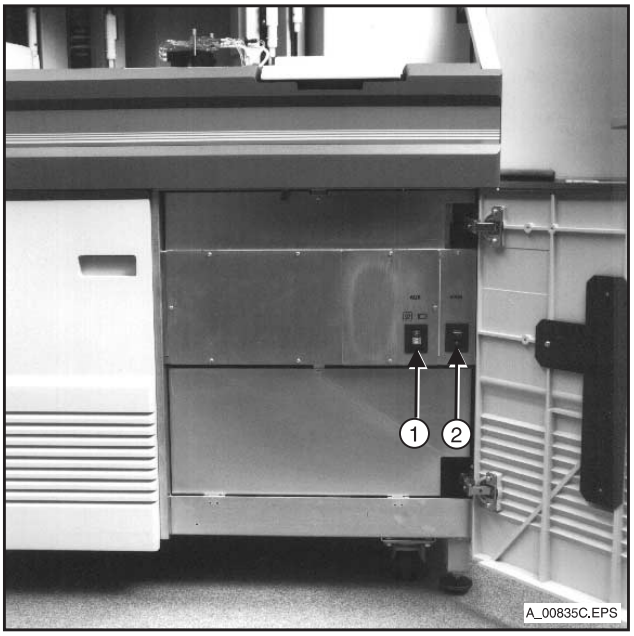
   "SYSTEM IDLE" "CX3/ISE: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?"
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.

6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn off CX Instrument and/or PC Console Power Now."

7. Turn the PC console power OFF using the switch located on the front of the console unit.

8. Open the right front door of the instrument (Figure 4-57). Leave the AUX power switch ON. Press the MAIN power switch to OFF. The green power lights for both MAIN and AUX will go out. Close the compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

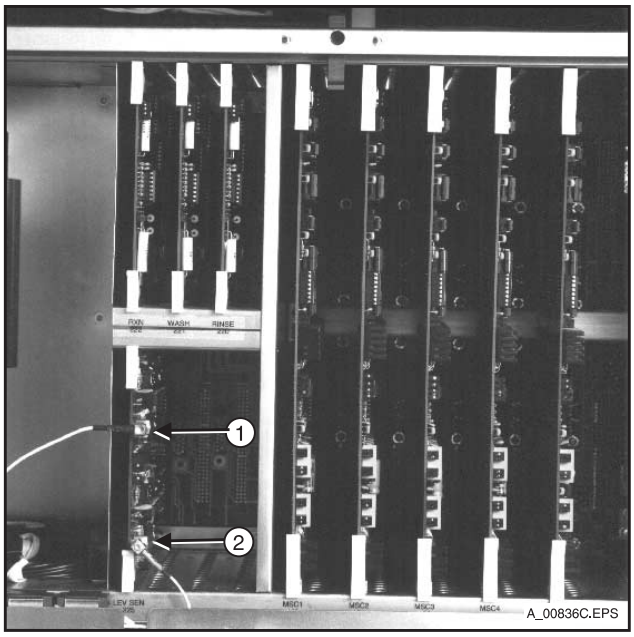
Figure 4-57. Power Switch

9. Open the cover to the electronics compartment. (Refer to Paragraph 4.4, for access to electronics compartment.)

CAUTION

To prevent damage due to static electrical discharge be sure wrist strap found in the central portion of the card cage (older models) or outside and on top of the card cage (newer models) is attached to operator's bare arm PRIOR to touching any boards. In order to provide adequate grounding, the wrist strap must be attached to the operator's bare arm. The wrist strap should not be attached to a sleeve or any other clothing on the arm.

10. Locate the level sense circuit board marked "LEV SEN 225" near the middle of the card cage (Figure 4-58).



1 - Line J911
2 - Line J912

Figure 4-58. Level Sense Circuit Board

NOTE

If replacing both sample and reagent probes, it is recommended that one probe be replaced at a time. This will simplify rerouting the cables. To prevent possible damage to probe tips it is recommended that the probes be manually lowered into the respective wash cups when working on them.

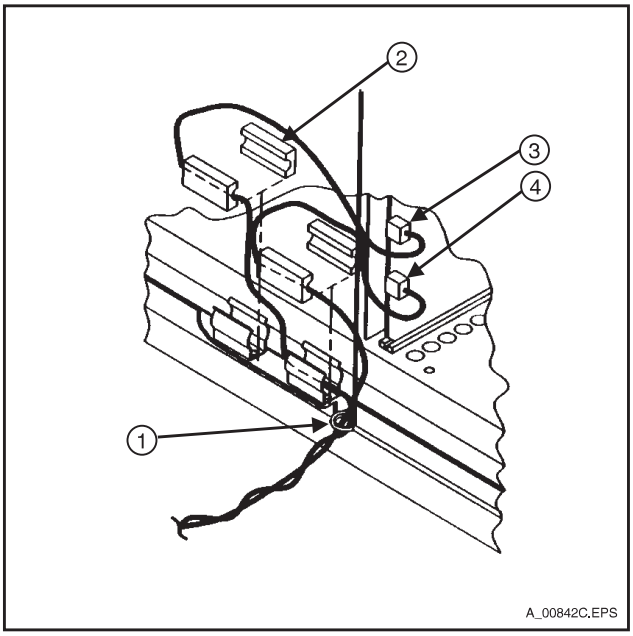
11. Depending on which probe you are installing, remove the appropriate cable from the Level Sense board as follows:

    (a) Firmly pressing on the edge of the Level Sense board to prevent it from coming out as you carefully unplug the right angle connector from the board.

        i. To remove the Sample Probe Assembly, remove line J911 which is connected to the top of the Level Sense board.

        ii. To remove Reagent Probe Assembly, remove line J912 which is connected to the bottom of the Level Sense board.

12. Locate the appropriate split ferrite bead found in the front lower ledge of the card cage (Figure 4-59).



1 - Round Rubber Grommet
2 - Split Ferrite Bead
3 - P911 Sample Probe Connector
4 - P912 Reagent Probe Connector

Figure 4-59. Electronics Compartment

13. Push the split ferrite bead to one side to remove it from it's clip.

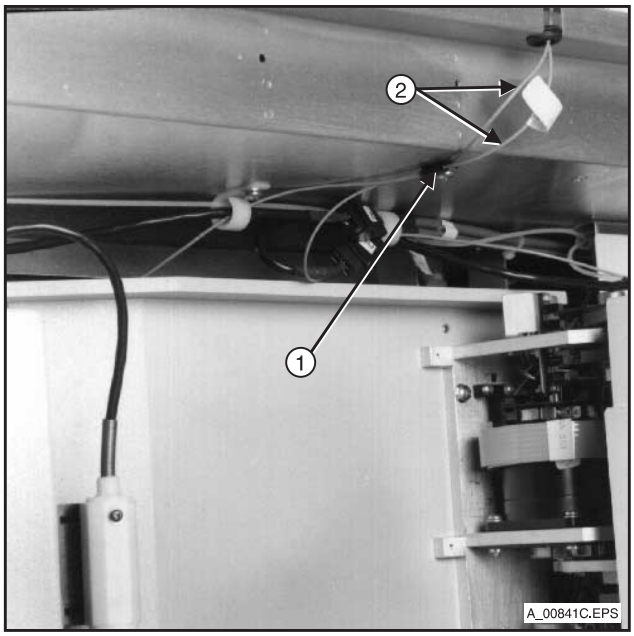
    (b) Separate the bead and remove the cable. Set the halves of the ferrite bead aside for later replacement.

14. Carefully push the metal right angle cable connector through the round rubber grommet that is used to protect the cable. If the grommet comes out of its hole in the card cage, replace by squeezing the grommet and aligning the groove in the grommet with the metal edge of the cutout in the card cage (Figure 4-59).

NOTE

When removing screws in this area it is recommended that a lab towel be placed across any areas into which a screw or washer might accidentally be dropped.

15. Being careful not to drop the Phillips screw, unscrew the common cable clamp located above the probe area but underneath the card cage (Figure 4-60). Remove the cable and set the screw and clamp aside for later reinstallation.



1 - Cable Clamps
2 - Level Sense Cables

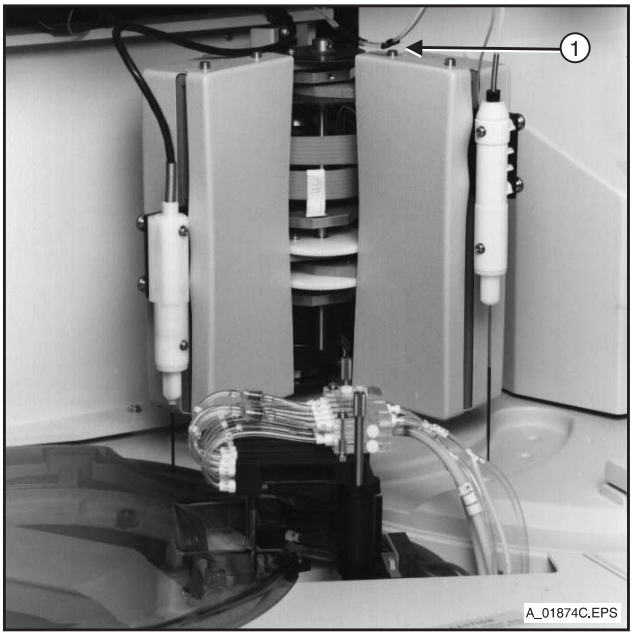
Figure 4-60. Release Lines from Cable Clamp

16. Remove the cable from any other clamps supporting it under the card cage.

NOTE

Before going on to the next step, locate the threaded wash line as it comes out of the top of the probe you are replacing. Take a marker and mark the area of the line that is currently being held by the cable clamp on top of the probe crane. This will aid in later reinstallation.

17. Remove the thumbscrew and black cable clamp from the top of the crane hexogonal standoff. Keep the thumbscrew and washer underneath for later reinstallation (Figure 4-61).



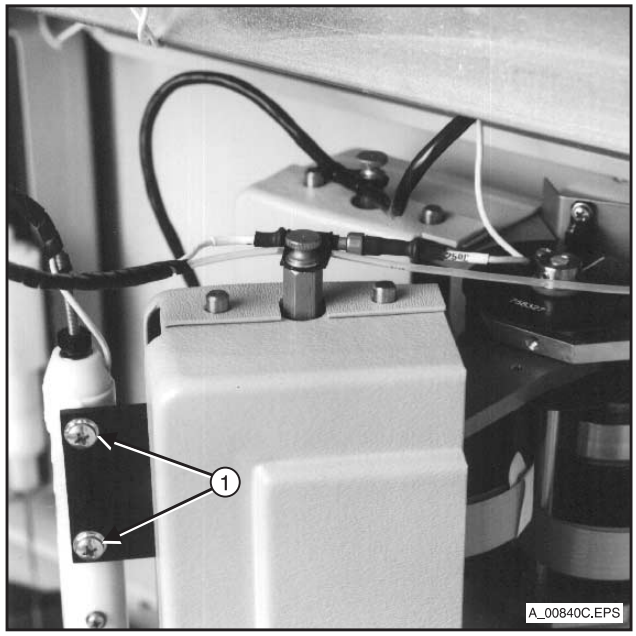
1 - Thumbscrew and black cable clamp

Figure 4-61. Remove the Small Black Cable from the Hexagonal Standoff

18. Locate the wash line which comes out of the top of the probe. Mark the wash line where the black plastic spiral wrap ends. This will help when rewrapping the new probe cable and wash line. Unscrew the fitting and remove the line from the top of the probe.

19. Carefully unwrap the plastic spiral wrap from around the level sense cable and wash line. Set the wrap aside for later reinstallation.

20. Remove the two Phillips head screws that attach the probe assembly to the black crane support. Set both aside for later reinstallation (Figure 4-62).



1 - Phillips Head Screws

Figure 4-62. Remove Phillips Head Screws

21. The probe assembly should now be free to remove from the system.

NOTE

In the following step, the probe should be installed so that the Phillips head screws are facing away from the center of the crane assembly. Install Phillips screws securely, but do not tighten. It will be necessary to adjust the position of the assembly on the mounting bracket. Alignment of the probe is described below.

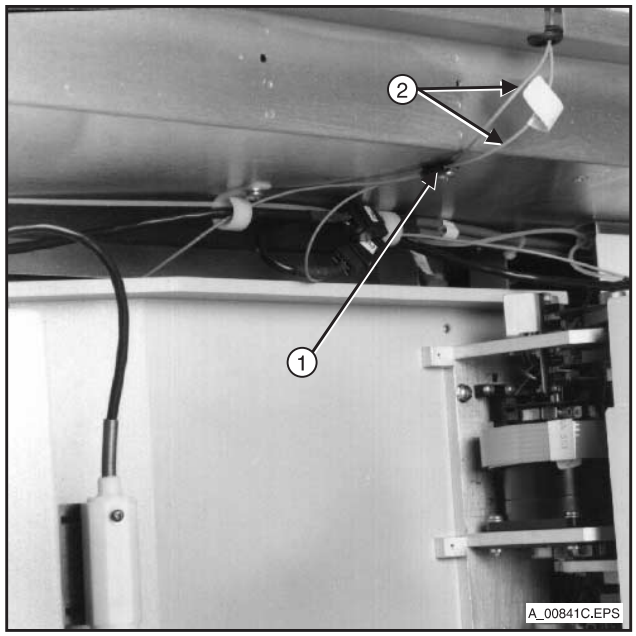
22. Mount the new probe assembly to the black crane support using the two Phillips head screws removed in step 20.

23. Attach the wash line fitting to the top of the new probe.

24. Rewrap the spiral wrap around the wash line and the level sense cable.

25. Thread the cable and wash line through the clamps on the underside of the card cage.

26. Using the Phillips screw removed earlier, reattach the common cable clamp to the underside of the card cage with both the sample level sense cable and the reagent level sense cable in place (Figure 4-63).



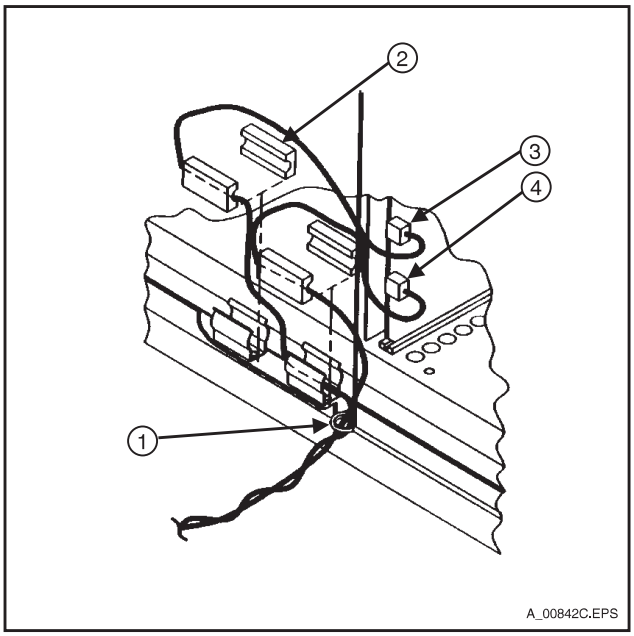
1 - Cable Clamp
2 - Level Sense Cables

Figure 4-63. Attach Level Sense Cables to the Common Cable Clamp

27. Attach the cable clamp to the end of the spiral wrapped wash line and cable farthest from the probe. Attach the clamp to the hexagonal standoff on top of the probe crane.

28. Move the tubing back and forth to make it is loose in the clamp.

29. Carefully thread the right angled connector of the level sense cable through the round rubber grommet on the underside of the card cage. The grommet may be removed from its cutout to accomplish this. Make sure the grommet is in place in the cutout on the floor of the card cage so that the level sense cable is not exposed to any sharp edges (Figure 4-64).



1 - Round Rubber Grommet
2 - Split Ferrite Bead
3 - P911 Sample Probe Connector
4 - P912 Reagent Probe Connector

Figure 4-64. Threading the Right Angled Connector of the Level Sense Probe

30. Reinstall the level sense cable in the split ferrite bead and replace the bead into the clips on the front lip of the card cage as illustrated (Figure 4-64).

31. Plug the right angle connector of the level sense cable into the appropriate plug on the level sense board.

    (a) For the Sample Probe Assembly, connect to the top port of the Level Sense board, line J911.

    (b) For the Reagent Probe Assembly, connect to the bottom of the Level Sense board, line J912.

32. Make sure that there is enough slack in the level sense cable at the probe crane so that the crane movement does not pull on the connector. There should be very little slack in the level sense cable within the card cage area.

NOTE

Since the power is off, the crane may be manually moved through its complete range of motion (left/right) to ensure that the level sense cable and wash line are not restricting motion. Re-orient the cable and wash line to eliminate any restriction.

33. Return the wrist strap to its storage position.
34. Replace the metal card cage cover as described in Paragraph 4.4.
35. Close the hinged electronic compartment cover.
36. Open the right front compartment door and press the MAIN Power switch to the ON position. The MAIN and AUX power switch green lights will come on. Close the door.
37. Turn the PC console ON using the switch on the front of the console unit.
38. After initialization is complete, from the MASTER screen, press the **F4 SPECIAL FUNCTION** key.
39. From the SPECIAL FUNCTIONS Screen, move the cursor to 3. Diagnostics/Alignment and press the **SELECT** key.

NOTE

Probe assembly alignment, vertical probe alignment and height adjustment must be performed whenever the probe assembly is removed or replaced.

40. Press **F4 CX4 DIAG**. If the screen prompts "Entering CX4 Diagnostics requires 5 minutes. Do you wish to continue (Y/N)?". Press Y, then **ENTER**.
41. The probe assembly alignment procedure is accessed through the CX4 diagnostics MAIN MENU Screen.
    (a) Press **F2 SET UP OPTIONS** to select operation mode.
    (b) Press **SELECT** to enter into the EXTENDED mode.
    (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
    (d) For sample probe replacement, cursor and **SELECT** 5. Sample System, or type 5 and **ENTER**. Proceed with Step 42.
    (e) For reagent probe replacement, cursor and **SELECT** 6. Reagent System or type **6** and **ENTER**.
42. Cursor and **SELECT** 1. Probe or type **1** and **ENTER**.
43. Press **F1 CONTINUE**.
44. When the system is ready, press **F1 ROTARY MOTOR**.
45. Press **ENTER** to move probe arm over the cuvette position.
46. Press **F1 VERTICAL POWER** to relieve power to the vertical motor.

CAUTION

Pressing the down arrow key releases power to the probe crane vertical motor and allows the operator to center the probe in the cuvette. Cuvette breakage may occur if the probe assembly is not gently lowered into the cuvette.

47. Center the probe between the front and rear walls of the cuvette.
48. Tighten the large Phillips screws securing the probe assembly to the black crane support. Observe that the probe remains centered in the cuvette.
49. Press **ENTER** to step through probe positions. Verify that the probe is centered in the cuvette by repeating Steps 45 and 46.

NOTE

If alignment is not successful at this point, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

50. Press **F8 DIAG MENU** to return the diagnostics MAIN MENU Screen.
51. Press **F2 SETUP OPTIONS**.
52. Press **SELECT** to enter into the ALIGNMENT mode.
53. Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
54. For probe vertical alignment, cursor and **SELECT** 5. Sample System, or type 5 and **ENTER**.
55. Cursor and **SELECT** 3. Probe Vertical Alignment, or type 3 and **ENTER**.
56. When probe vertical alignment is complete, press **PREV SCREEN** to return to SAMPLE HANDLING SYSTEM menu.
57. For probe height adjustment, cursor and **SELECT** 7. Probe Height Adjustment, or type 7 and **ENTER**.

58. Follow the procedural steps outlined on the screen.
59. When probe height adjustment is complete, press **F8 DIAG MENU** to enter the CX4 diagnostics MAIN MENU Screen.
60. Press **PREV SCREEN** to exit CX4 diagnostics and return to the diagnostics entry screen.
61. Press **MASTER SCREEN** to return to the OPERATING PROGRAM MASTER Screen.
62. Replace Covers.

4.10.3.2 Sample/Reagent Probe Insert Replacement (Quick Connect Probes)

NOTE

If replacing both sample and reagent probes, it is recommended that one probe be replaced at a time. These directions have been written to show the replacement of one probe. Repeat Steps 10 through 29 to replace an additional probe after completing installation of the first.

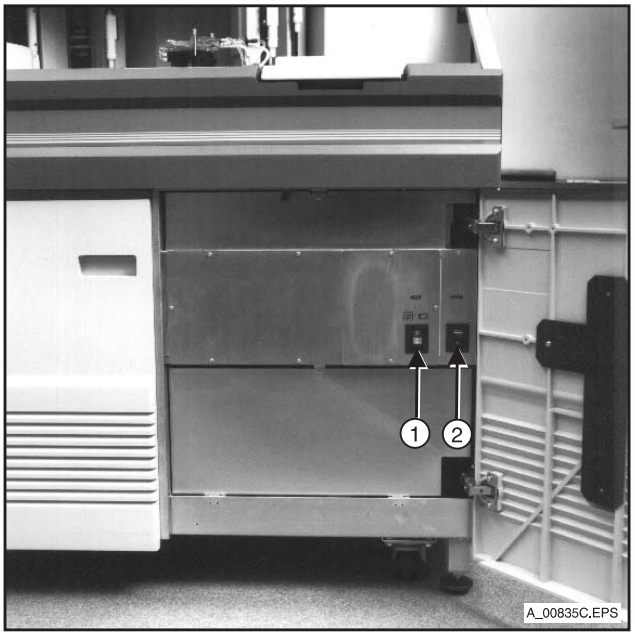
NOTE

DO NOT remove the two Phillips head screws that support the probe assembly to the black crane support.

1. From the MASTER Screen, press the **IDLE** key. The screen will prompt: "Continue with the shut down procedure (Y/N)?".
2. Press the **Y** key, then **ENTER**. After a short delay, the screen will display the following message in the status area:

   "SYSTEM IDLE" "CX3/ISE: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?".
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn off CX Instrument and/or PC Console Power Now".
7. Turn the PC Console power off using the switch located on the front of the console unit.
8. Open the right, front door of the instrument (Figure 4-65). Leave the AUX power switch ON. Press the MAIN power switch to OFF. The green power lights for both MAIN and AUX will go out. Close the compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

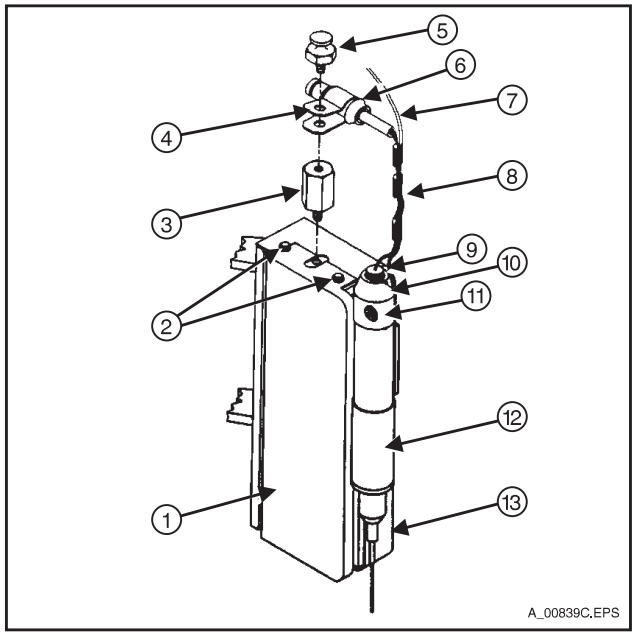
Figure 4-65. Power Switch

9. Open the cover of the electronics compartment. (Refer to the Diagnostic and Troubleshooting Guide, Paragraph 4.4, if necessary, for access instructions to the electronics compartment). Opening the cover is done only to provide more room to work on the probe.

NOTE

Make sure that the auto-loader cover, sample carousel cover and reaction carousel cover are in place before starting. It is also recommended that a lab towel be placed over any area into which a screw or small part may be dropped while performing the steps below.

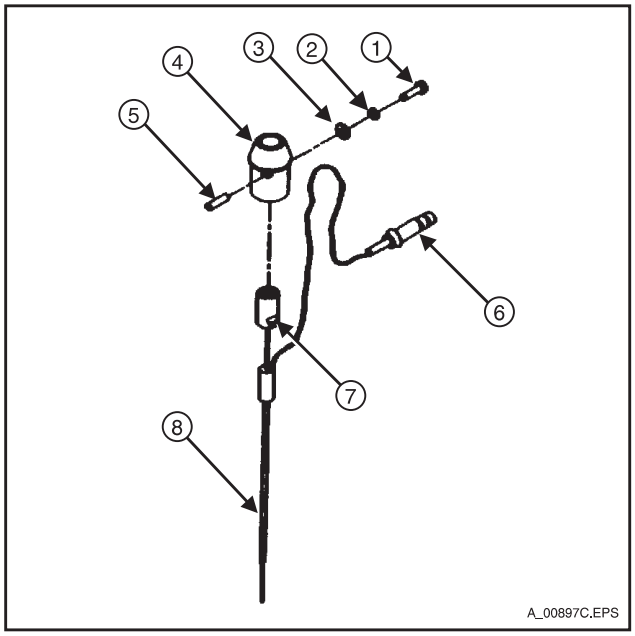
Align the probe being serviced over the appropriate wash cup and gently push the probe down into the cup. This will protect the probe in the following steps and catch any excess fluid that may remain in the probe and wash line.



1 - Inner Crank Cover
2 - Crank Cover Studs
3 - Hexagonal Standoff
4 - Cable Clamp
5 - Thumb Screw
6 - Level Sense Cable Connector
7 - Washline
8 - Spiral Wrap
9 - Threaded Washline
10 - Plastic Probe Top
11 - Top Phillips Screw
12 - Probe Housing
13 - Outer Crank Cover

Figure 4-66. Probe Unit

10. Carefully unwrap the black plastic spiral wrap from around the level sense cable and wash line starting at the probe and ending at the hexogonal standoff (Figure 4-66).
11. Unscrew the threaded wash line fitted from the top of the probe (Figure 4-66).
12. Carefully disconnect the level sense cable connection at the black clamp located next to the hexogonal standoff by pulling against the raised collars of each half of the connector. ONLY the probe level sense cable should be threaded through the black cable clamp (Figure 4-66). DO NOT TWIST OR PULL ON THE WIRES.
13. Remove the single, small Phillips head screw and two washers (one inner flat washer and one outer lock washer) located at the TOP of the probe housing opposite the upper large Phillips head mounting screw (Figure 4-66).
    (a) DO NOT remove the bottom screw.
    (b) Set screw and washers aside for later reinstallation.
14. Lift the plastic probe top along with the internal metal probe from the probe housing. A slight twisting motion may be necessary if the fit is tight (Figure 4-66).



1 - Phillips Head Screw
2 - Lock Washer
3 - Flat Washer
4 - Probe Top
5 - Alignment Pin
6 - Cable Clamp Goes Here
7 - Cutout in Internal Probe Aligns With Large Opening in Probe Top
8 - Internal Metal Probe

Figure 4-67. Sample and Reagent Probe Units

NOTE

In the next step use care in removing the small metal alignment pin. It is round and will roll easily.

15. Using a wooden applicator stick or similar tool (DO NOT use anything sharp) push the metal alignment pin out of the side of the plastic probe top (Figure 4-67). This pin holds the metal internal portion of the probe in place. Set the pin aside for later reinstallation.
16. Remove the metal internal portion of the probe from the white plastic probe top and discard (Figure 4-67).
17. Place the top of the new quick connect internal metal probe into the white plastic top of the probe holder.
18. Align the cutout in the top of the internal metal probe with the large opening in the side of the white plastic probe top (Figure 4-67).

19. Insert the metal alignment pin into the hole to lock the internal probe in place. Use a wooden applicator stick or similar tool to press the pin firmly in place (Figure 4-67). DO NOT use anything sharp.
20. Lay the new level sense cable into the groove on the outside of the white plastic probe top.
    (a) The fit between the groove and the cable is very tight. Press the cable firmly to ensure that it is properly seated in the groove.

NOTE

In the following step use care in inserting the new probe to prevent possible damage to the teflon coating of the metal probe tip.

21. Remove any protective covering from the new probe (Figure 4-67).
    (a) Align the small screw hole in the white plastic probe top with the screw hole in the probe housing (which is still attached to the crane arm).
    (b) Insert the new probe and white plastic probe top assembly into the probe holder which is still attached to the crane arm.
22. Replace the small, single Phillips head screw and both the inner flat washer and the outer lock washer. It may be necessary to rotate the probe top slightly to align the screw holes (Figure 4-67).
23. Firmly screw in the wash line fitting in the top of the probe assembly (Figure 4-66).

NOTE

To perform the next step it may be necessary to move the part number tag found on the level sense line of the probe as far away from the probe as possible. If necessary, it should be removed.

24. Rewrap the black plastic spiral wrap around the wash line and the level sense cable.
25. Make sure the wash line tubing is outside the new cable clamp.
26. Make sure that there is enough slack in the level sense cable at the probe crane so that the crane movement does not pull on the connector.

NOTE

The power is off. The crane should be manually raised up to the top of its travel. It should then be moved through its complete range of motion (left/right) to ensure that the level sense cable and wash line are not restricting crane motion. If they are, re-orient the cable and wash line to eliminate the restriction. Also move the probe carefully up and down in the appropriate wash cup to check for restrictions.

27. If a second probe is to be changed at this time repeat steps 10 through 26.
28. Close the hinged electronics compartment cover. (If necessary, refer to paragraph 4.4 for detailed instructions.)
29. Open the right front compartment door and press the MAIN power switch to the ON position. The MAIN and AUX power switch green lights will come on. Close the compartment door.
30. Turn the PC console power ON using the switch on the front of the console unit.

NOTE

Probe assembly alignment, vertical probe alignment and height adjustment are necessary whenever the assembly is removed or replaced.

31. After initialization is complete, from the MASTER screen press the **F4 SPECIAL FUNCTION** key.
32. From the SPECIAL FUNCTIONS screen, move the cursor to 3. Diagnostics/Alignment and press the **SELECT** key.
33. Press **F4 CX4 DIAG**. If the screen prompts “Entering CX4 Diagnostics requires 5 minutes. Do you wish to continue (Y/N)?”, press **Y**, then **ENTER**.
34. The probe assembly alignment procedure is accessed through the CX4 diagnostics MAIN MENU Screen.
    (a) Press **F2 SET UP OPTIONS** to select operation mode.
    (b) Press **SELECT** to enter into the EXTENDED mode.
    (c) Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.

(d) For sample probe replacement, cursor and **SELECT** 5. Sample System, or type **5** and **ENTER**. Proceed with Step 35.

(e) For reagent probe replacement, cursor and **SELECT** 6. Reagent System or type **6** and **ENTER**.

35. Cursor and **SELECT** 1. Probe or type **1** and **ENTER**.
36. Press **F1 CONTINUE**.
37. When the system is ready, press **F1 ROTARY MOTOR**.
38. Press **ENTER** to move probe arm over the cuvette position.
39. Press **F1 VERTICAL POWER** to relieve power to the vertical motor.

CAUTION

Pressing the down arrow key releases power to the probe crane vertical motor and allows the operator to center the probe in the cuvette. Cuvette breakage may occur if the probe assembly is not gently lowered into the cuvette.

40. Center the probe between the front and rear walls of the cuvette.
41. Tighten the large Phillips screws securing the probe assembly to the black crane support. Observe that the probe remains centered in the cuvette.
42. Press **ENTER** to step through probe positions. Verify that the probe is centered in the cuvette by repeating Steps 38 and 39.

NOTE

If alignment is not successful at this point, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

43. Press **F8 DIAG MENU** to return the diagnostics MAIN MENU Screen.
44. Press **F2 SETUP OPTIONS**.
45. Press **SELECT** to enter into the ALIGNMENT mode.
46. Press **PREV SCREEN** to return to the diagnostics MAIN MENU Screen.
47. For probe vertical alignment, cursor and **SELECT** 5. Sample System, or type **5** and **ENTER**.
48. Cursor and **SELECT** 3. Probe Vertical Alignment, or type **3** and **ENTER**.
49. When probe vertical alignment is complete, press **PREV SCREEN** to return to SAMPLE HANDLING SYSTEM menu.
50. For probe height adjustment, cursor and **SELECT** 7. Probe Height Adjustment, or type **7** and **ENTER**.
51. Follow the procedural steps outlined on the screen.
52. When probe height adjustment is complete, press **F8 DIAG MENU** to enter the CX4 diagnostics MAIN MENU Screen.
53. Press **PREV SCREEN** to exit CX4 diagnostics and return to the diagnostics entry screen.
54. Press **MASTER SCREEN** to return to the OPERATING PROGRAM MASTER Screen.
55. Replace Covers.

4.10.4 Sample and Reagent Syringe Assembly Replacement

For instructions on sample and reagent syringe assembly, refer to the appropriate Operating Instructions for replacing Sample and Reagent Plunger Tips.

4.10.5 Sample and Reagent Three-way Shear Valve Replacement

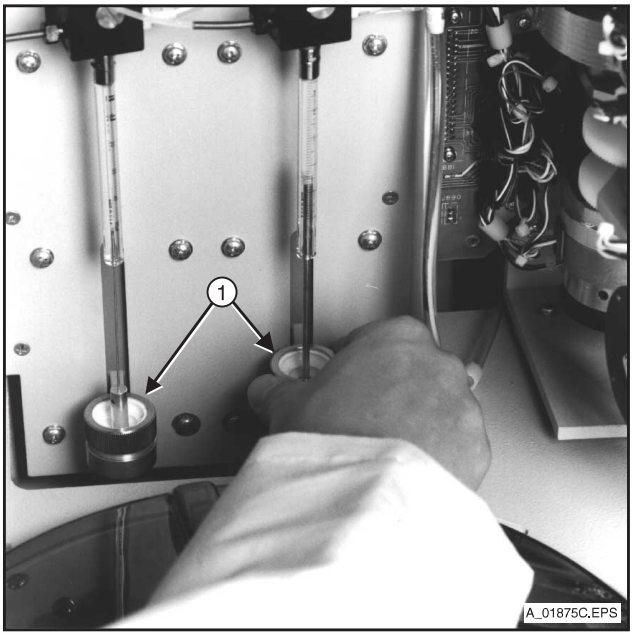
1. Fully extend the syringe plungers to the bottom of the syringe barrels as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

   (b) Cursor and **SELECT** 6. Maintenance Procedures or type **6 ENTER**.

   (c) Cursor and **SELECT** 2. Syringe Tip Replacement or type **2 ENTER**.

2. Turn the barrel of the reagent (right) syringe clockwise to release syringe. Loosen the round coupling nut at the base of the plunger rod of the syringe (Figure 4-68).



1 - Coupling Nut

Figure 4-68. Loosening Coupling Nut.

3. Lower syringe slightly and pull up and out. Set syringe aside (Figure 4-69).

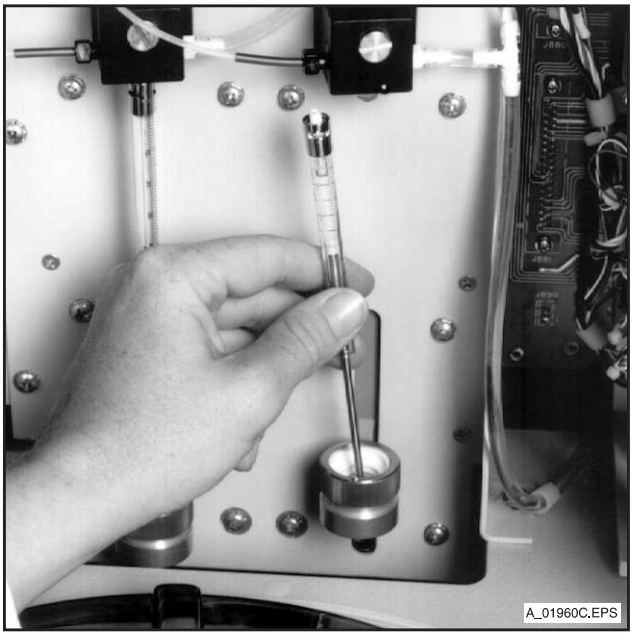


Figure 4-69. Lower Syringe.

4. Release the tubing from the right side of the valve. Unscrew the line from the left side of the valve (Figure 4-70).

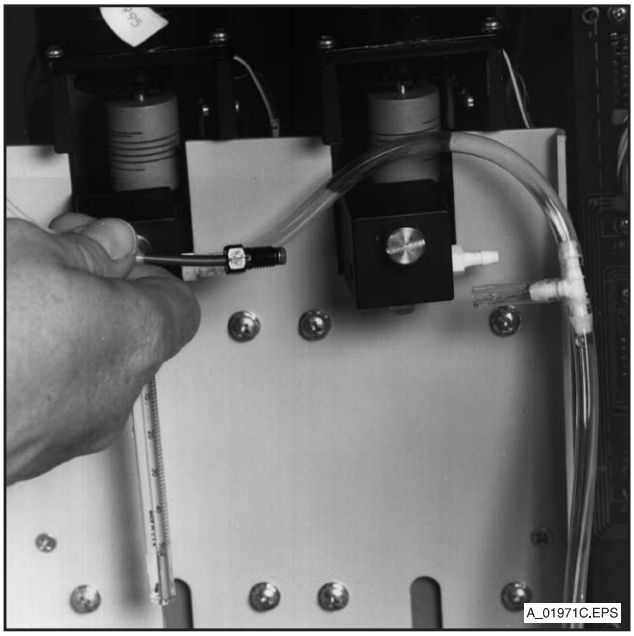


Figure 4-70. Unscrew Line from Left Side of Valve.

5. Loosen the front screw and take off valve (Figure 4-71).

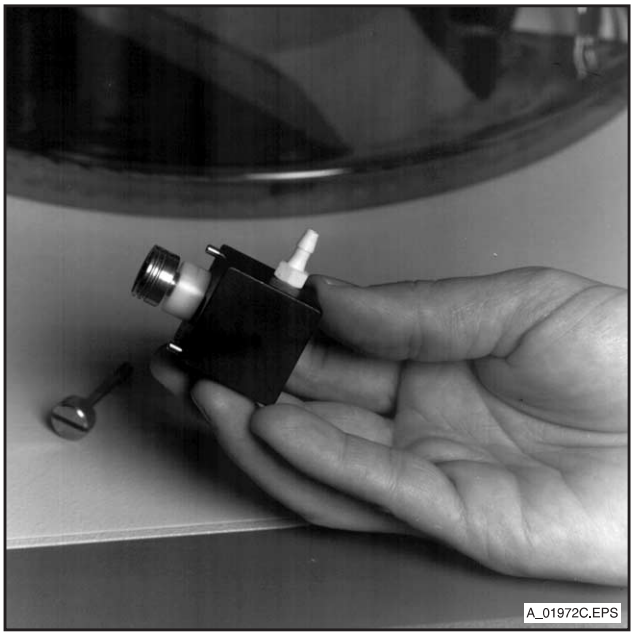


Figure 4-71. Take Off Valve.

6. Replace with new valve. Reconnect the line and tubing to the new valve assembly (Figure 4-72).

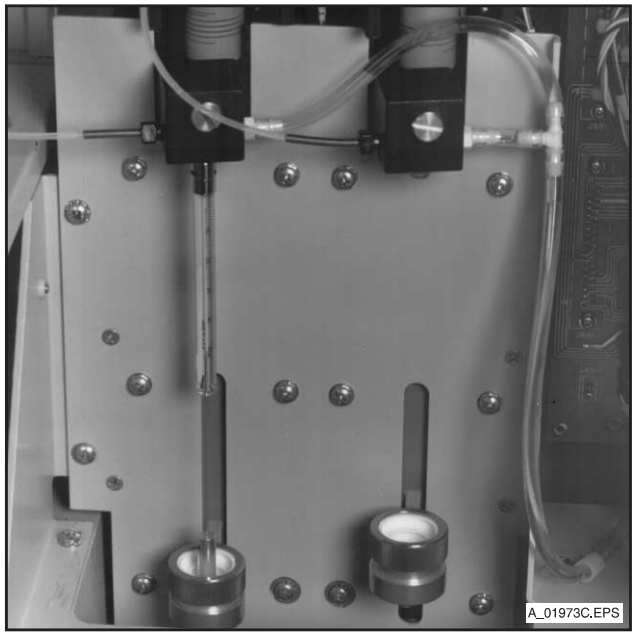


Figure 4-72. Reconnect Line and Tubing to New Valve Assembly.

7. Reinstall the syringe as follows:
   (a) Insert the base of the plunger into the white rubber coupling.
   (b) Re-tighten the round coupling nut finger-tight.
   (c) Carefully pull the syringe barrel upward until the syringe Luer-lock fitting is engaged.
8. Repeat this procedure on the right (reagent) valve.
9. Press **ENTER** to drive the plunger to the top of the syringe.

NOTE

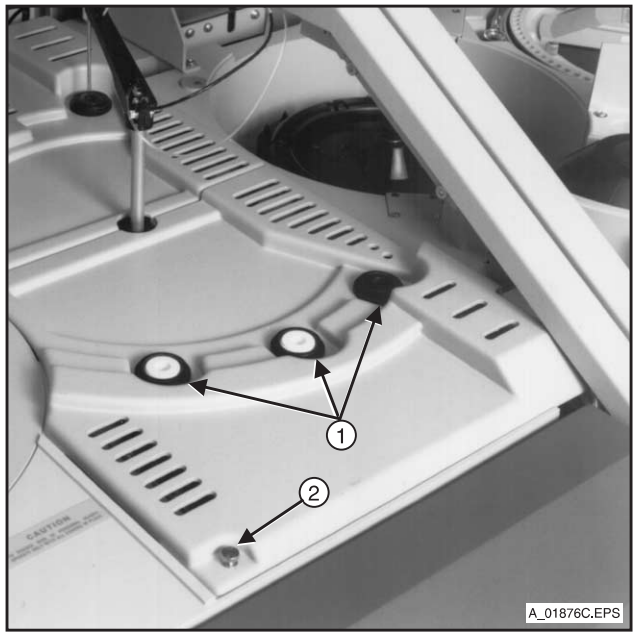
If a motion error on the syringe occurs, the plunger is not properly seated in the white coupling.

The following procedures apply to the CX3 (CX7 Users only).

4.11 CHEMISTRY MODULE REPLACEMENT

4.11.1 BUN or Glucose Module Removal and Replacement

1. Remove front three retaining nuts and retaining screw (Figure 4-73) and remove the chemistry cup shield located over the BUN, glucose, and total protein (or calcium) reaction cups.



1 - Retaining Nuts
2 - Retaining Screw

Figure 4-73. Removing Front Chemistry Cup Shield

2. Open CX3 reagent compartment door.
3. Remove reagent line from BUN or Glucose reagent bottle.
4. Prepare module for replacement. Program system as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** BUN3 or GLU3.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type 3 and press ENTER. The display indicates the number of primes remaining.

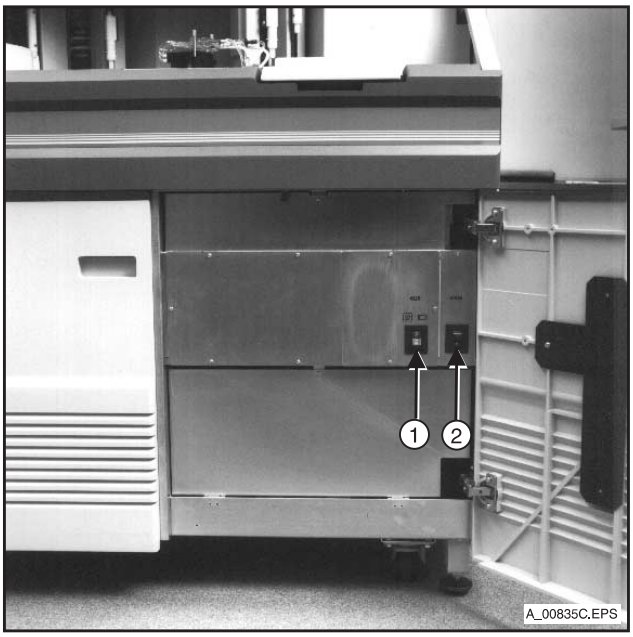
5. When priming has completed, press **MASTER SCREEN**.
6. Press **SYS IDLE**. The screen will prompt: “Continue with the shut down procedure (Y/N)?”
7. Press **Y**, then **ENTER**. The screen will display:

   “SYSTEM IDLE” “CX3: STANDBY”
   “CONSOLE: “ “CX4: STANDBY”

8. Press **F4 RESUME**. The screen will prompt: “This will reboot the system. Continue with the Resume procedure?”
9. Press **Y**, then **ENTER**. The message display window will prompt: “Press <PREV SCREEN> to continue” (flashing message).
10. Press **PREV SCREEN**. A window will pop up giving four boot options.
11. Press **1**. A red “**POWER DOWN SCREEN**” will prompt you to: “Turn off CX Instrument and/or PC Console Power Now.”

    (a) Turn the PC console power OFF using the switch on the front of the console unit.

12. Press MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-74). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

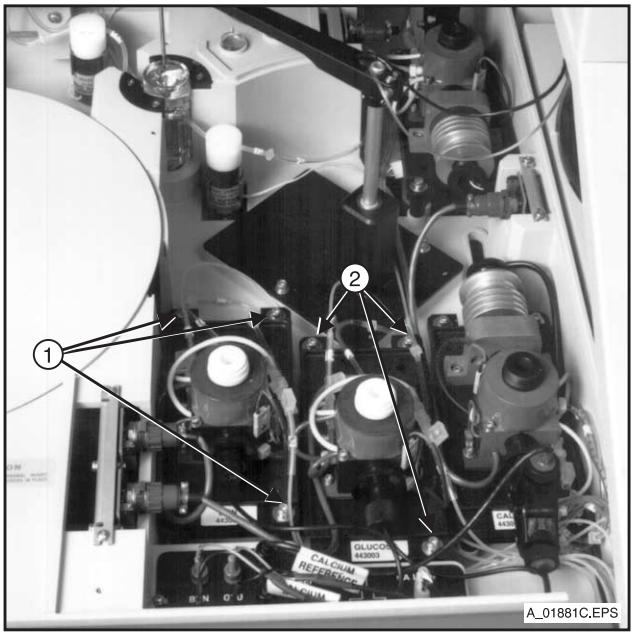
Figure 4-74. Power Switch

13. Before proceeding...

WARNING

TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

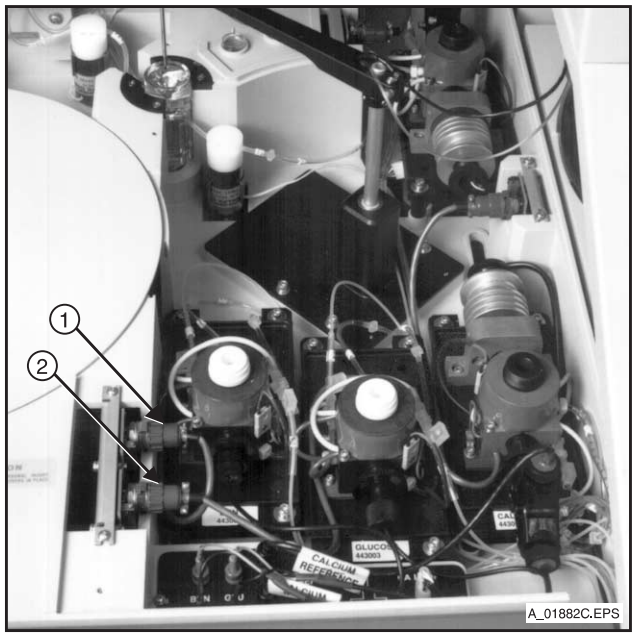
14. Unscrew the three module retaining screws. There are two screws located at the rear of the module and one at the front (Figure 4-75).



1 - BUN3 Retaining Screws
2 - GLU3 Retaining Screws

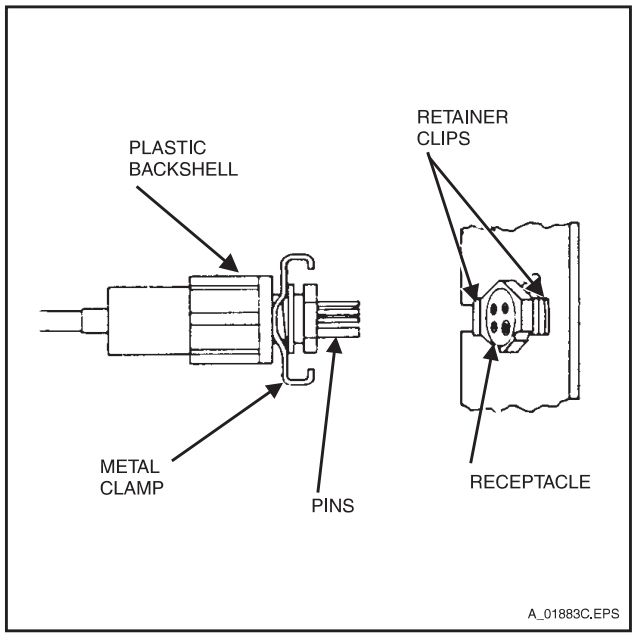
Figure 4-75. Removing BUN3 or GLU3 Chemistry Module

15. Disconnect the heater cable from the connector panel (located to the left of the BUN and glucose modules, Figure 4-76A). This may be done by turning the plastic backshell portion of the connector counterclockwise until loose, then turn the metal clamp until it releases from retainer clips (Figure 4-76B). (You may need to use a screwdriver.) Pull connector straight out until the pins disengage.



A. Heater Cable and Connector

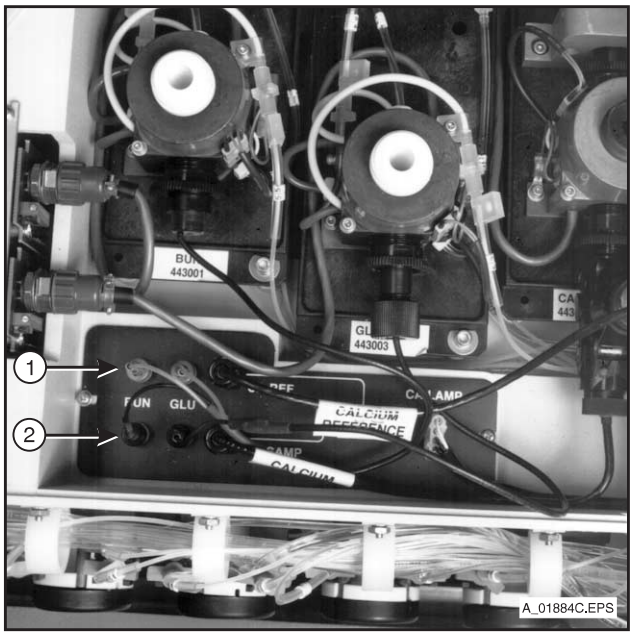
1 - BUN3 Heater Cable
2 - GLU3 Heater Cable



B. Retainer Clips

Figure 4-76. Disconnect Heater Cable

16. Pull to disconnect red and black leads from connector panel (Figure 4-77).



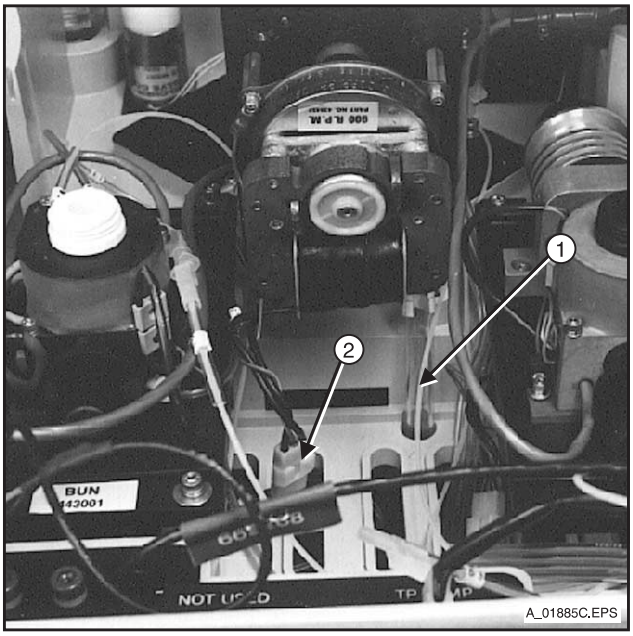
1 - Red
2 - Black

Figure 4-77. Disconnect Red and Black Pin Leads

17. Remove the BUN or glucose electrode from the module. Set aside for later reinstallation in new module.
18. Carefully remove all tubing attached to the BUN or glucose cup assembly (lines #16, #15, #55, and #56 for BUN or lines #12, #11, #53, and #54 for glucose).
19. Lift module to expose large drain tubing attached to the underside and the mixer cable extending from the module (Figure 4-78).

NOTICE

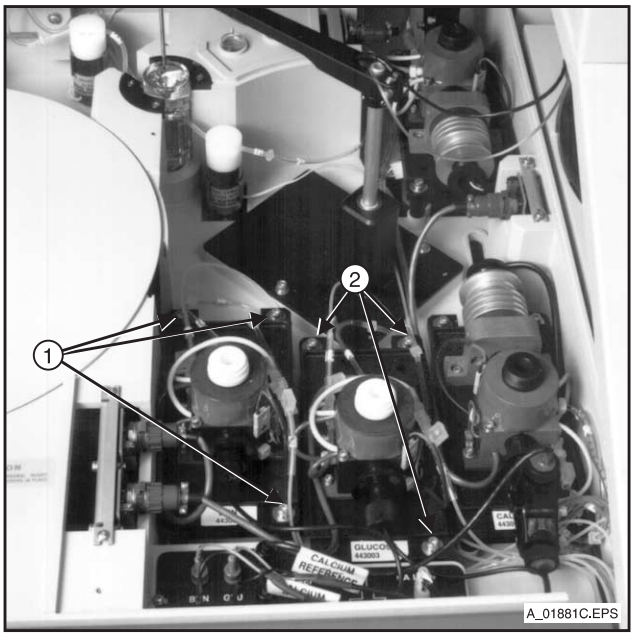
Take care not to allow drain tubing and mixer cable to fall down inside the system as retrieval may be difficult.



1 - Large Drain Tube
2 - Mixer Cable

Figure 4-78. Lift Module

20. Disconnect drain tubing and mixer cable (Figure 4-78).
21. Remove module from system.
22. Connect mixer cable.
23. Attach large drain tube to bottom of new module.
24. Install new module. Take care not to pinch any lines or tubing.
25. Connect all tubing (lines #16, #15, #55, and #56 for BUN or lines #12, #11, #53, and #54 for glucose).
26. Install the three module retaining screws and tighten until snug (Figure 4-79).



1 - BUN3 Retaining Screws
2 - GLU3 Retaining Screws

Figure 4-79. Install Module

27. Connect the heater cable to connector panel (Figure 4-80).

1 - Heater Cables
2 - Connector Panel

Figure 4-80. Connect Heater Cable to Connector Panel

NOTE

Heater cable connector is configured and will only plug into panel one way.

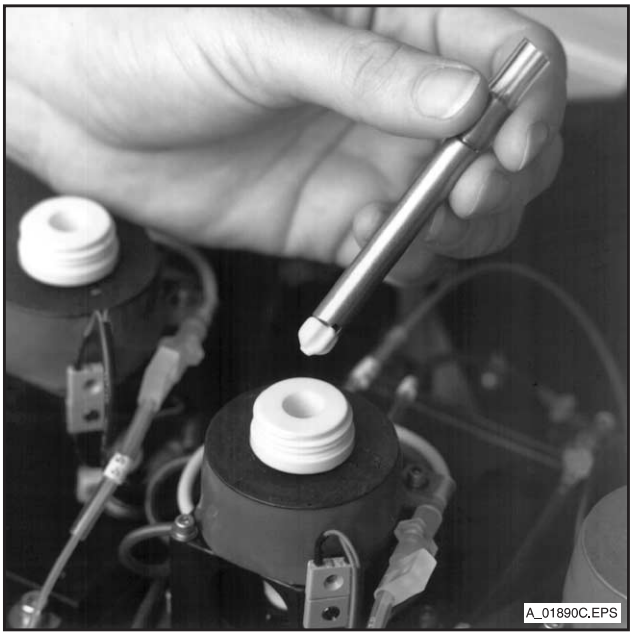
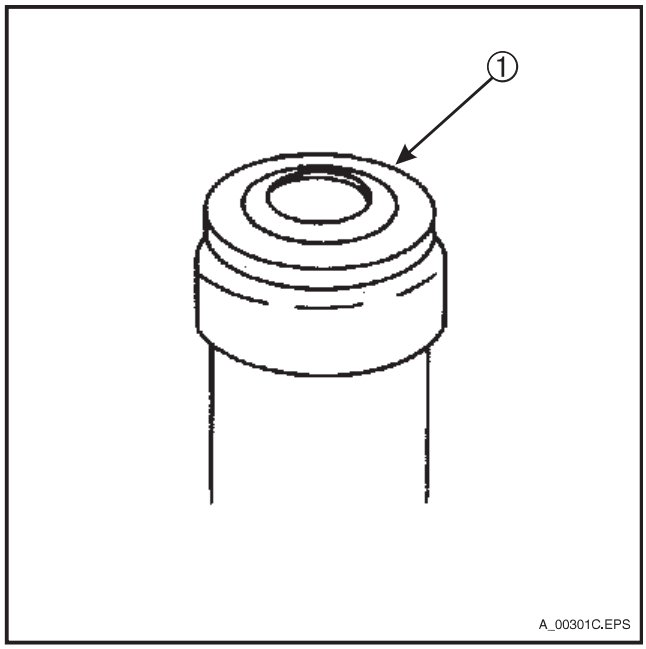


Figure 4-81. Install Stirrer

28. Install new stirrer in new module (Figure 4-81).
29. Prepare electrode (removed from old module) for reinstallation as follows:

    FOR BUN ELECTRODE:

    (a) Remove quad-ring from front face of electrode (Figure 4-82)



1 - Quad Ring

Figure 4-82. End View of BUN Electrode

CAUTION

Avoid scratching gold coating on face of electrode as excessive scratching may adversely affect performance.

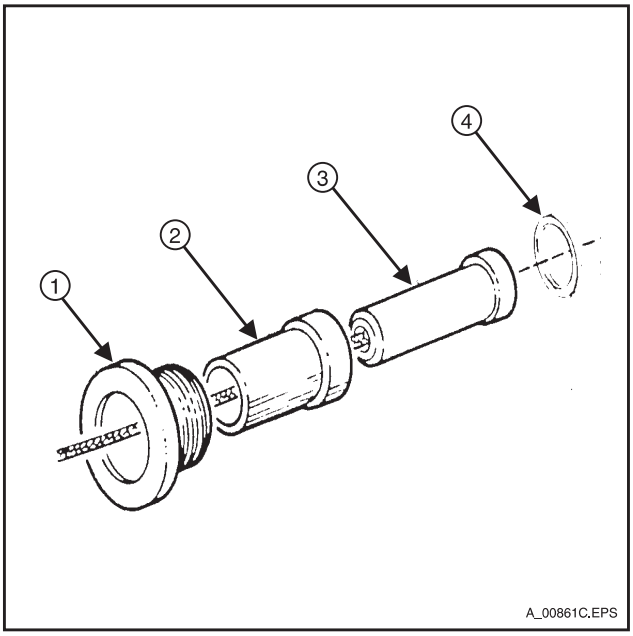
(b) Rinse quad-ring in deionized water and dry using lintless tissue.

(c) Use lintless tissue moistened with 70% isopropanol to clean electrode face until gold surface is bright. Rub parallel to the gap with tissue. Rinse with deionized water. Dry using lintless tissue.

(d) Apply thin coating of Silicone Compound (P/N 879049) over tip of electrode. Carefully wipe electrode end parallel to the gap with lintless tissue to remove all evidence of compound. Rub to a bright finish.

(e) Reinstall quad-ring on face of electrode.

(f) Reinstall retainer on BUN electrode (Figure 4-83).



1 - Retainer Nut
2 - Electrode Retainer
3 - Electrode
4 - Quad-Ring

Figure 4-83. Disassembled BUN Electrode

(g) Rotate electrode until electrode key enters retainer keyway.

(h) Reinstall retainer nut on electrode-retainer assembly.

(i) Align keyway on body of retainer containing electrode with key in electrode port and install electrode assembly. Finger-tighten retainer nut. Proceed to Step 30.

FOR GLUCOSE ELECTRODE:

Recharge electrode as follows:

(a) Unscrew electrode cap nut and withdraw electrode from retainer. Set retainer nut aside for later reinstallation.

(b) Remove O-ring and membrane from end of retainer. Discard membrane.

(c) Rinse retainer and O-ring in deionized water and dry with lintless tissue.

(d) Place O-ring on sheet of lintless paper.

(e) Place new membrane (make sure there is only one) on top of O-ring and center. Avoid contacting membrane with fingers.

NOTE

Always discard paper disk that separates new membranes.

(f) Push electrode retainer onto O-ring. Check membrane for proper seating: no wrinkles or tears in the membrane appearance.

CAUTION

Do not seat membrane on retainer with twisting motion as retainer could slice membrane.

(g) Place retainer nut on retainer and set aside for later use.

(h) Wipe old gel from face of electrode and rinse electrode body thoroughly in deionized water. Wipe circular silver anode firmly with clean, moistened tissue and use edge of fingernail to remove oxidation products. The wooden end of an applicator stick may also be used, but DO NOT use a needle or any other metal object.

CAUTION

Never rinse electrode in alcohol, as damage to the electrode may result.

(i) Wipe electrode dry.

(j) Apply liberal amount of gel to tip of electrode, then wipe away to condition electrode glass for fresh charge of gel.

(k) Apply fresh gel to electrode tip, to a depth of 1/16 to 1/8 inch (1.59 to 3.18 mm). Cover entire tip of electrode, being careful not to leave air bubbles.

Reinstall the glucose electrode as follows:

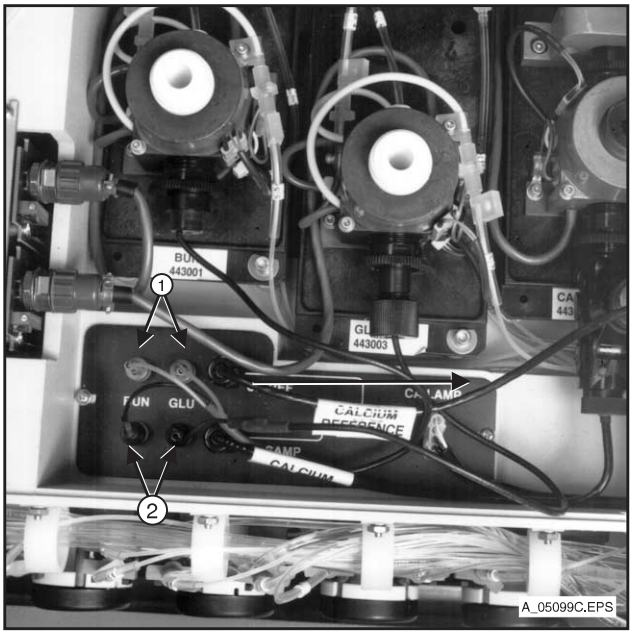
CAUTION

DO NOT over tighten electrode cap nut (step l) as membrane and O-ring can be pushed off the end of the retainer.

(a) Align key on electrode with keyway in retainer. Carefully insert electrode into retainer. Finger tighten electrode cap nut.

(b) Align key on electrode-retainer assembly with keyway on electrode port and finger-tighten in place with retainer nut. Proceed with Step 30.

30. Reconnect red and black BUN pin leads into connector panel (Figure 4-84).



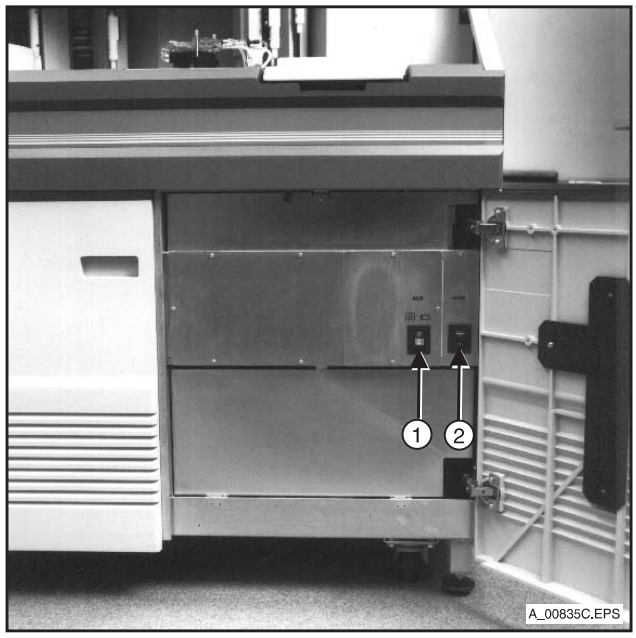
1 - Red
2 - Black

Figure 4-84. Reconnect Red and Black Pin Leads

31. Reconnect system power cord to power source.

32. Press main system power switch to the ON position (Figure 4-85).

(a) Turn the PC console ON using the switch on the front of the console unit.



1 - Aux. Power Switch
2 - Main Power Switch

Figure 4-85. Power Switch

33. Prime as follows:

(a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

(b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

(c) Cursor and **SELECT** BUN3 or GLU3.

(d) Press **F1 START PRIME**.

(e) Operator is prompted to enter the number of prime cycles. Type **3** and press **ENTER**. The display indicates the number of primes remaining.

34. While module is priming, observe lines and chemistry reaction cup to determine if there are any leaks. Stop the priming if any leaks are noticed and correct the problem.

35. Observe stirrer to verify that it is rotating properly.

36. Carefully place shield over chemistry reaction cups. Take care that wires and tubes are not pinched under edges of cover.

37. Replace and secure the three retaining nuts and two thumb screws on the shield.

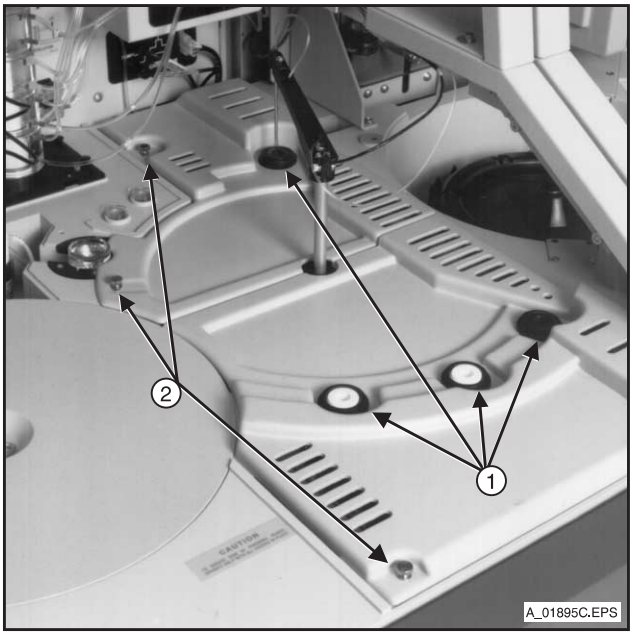
NOTE

When reinstalling chemistry reaction cup module, be sure to properly align module with the sample probe. This will prevent any damage from occurring to the sample probe or reaction cup.

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.11.2 Creatinine, Total Protein or Calcium Module Removal and Replacement

1. Remove both the front and rear shields over the chemistry reaction cups as follows:
   (a) Unscrew all four retaining nuts and three thumb screws (Figure 4-86).



1 - Retaining Nuts
2 - Retaining Screws

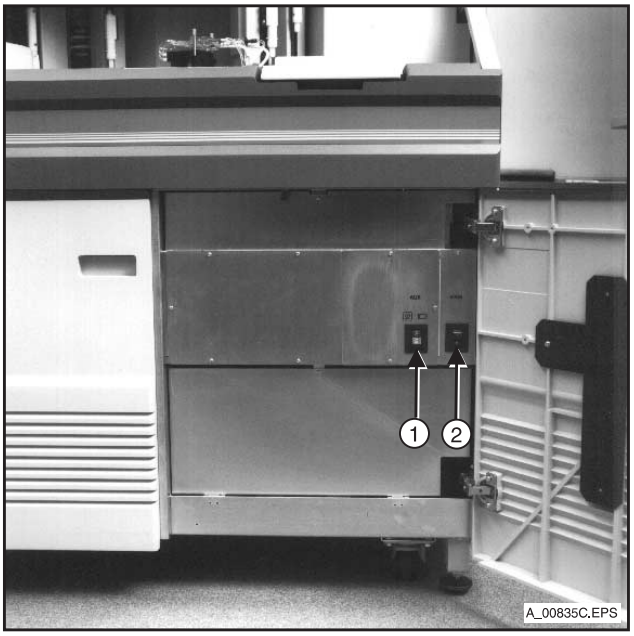
Figure 4-86. Remove Front and Rear Chemistry Cup Shields

   (b) Remove the front shield located over the BUN, glucose and total protein or calcium chemistry reaction cups.
   (c) Program the system as follows:
      i. From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
      ii. Cursor and **SELECT** 6. Maintenance Procedures or type **6** and **ENTER**.
      iii. Cursor and **SELECT** 5. CX3 Sample Probe Maintenance or type **5** and **ENTER**. The sample probe arm will rotate away from the electrolyte injection cup.
      iv. Remove the rear shield located over the creatinine chemistry reaction cup.
      v. Press **PREV SCREEN** to home probe.
      vi. Press **MASTER SCREEN**.
2. Open CX3 reagent compartment door.
3. Remove reagent line from Creatinine, Total Protein (or Calcium) reagent bottle.
4. Prepare module for replacement. Program system as follows:
   (a) From the MASTER Screen, press **F4**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** CRE3, TP3 (or CA3).
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type **3** and press **ENTER**. The display indicates the number of primes remaining.
5. When priming is completed press **MASTER SCREEN**.
6. Press **SYS IDLE**. The screen will prompt: “Continue with the shut down procedure (Y/N)?”
7. Press **Y**, then **ENTER**. The screen will display:

   “SYSTEM IDLE” “CX3: STANDBY”
   “CONSOLE: “ “CX4: STANDBY”

8. Press **F4 RESUME**. The screen will prompt: “This will reboot the system. Continue with the Resume procedure (Y/N)?”
9. Press **Y**, then **ENTER**. The message display window will prompt: “Press <**PREV SCREEN**> to continue” (flashing message).
10. Press **PREV SCREEN**. A window will pop up giving four boot options.
11. Press **1**. A red “**POWER DOWN SCREEN**” will prompt you to: “Turn off CX Instrument and/or PC Console Power Now.”
   (a) Turn the PC console power OFF using the switch on the front of the console unit.

12. Press MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-87). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-87. Power Switch

13. Before proceeding...

WARNING

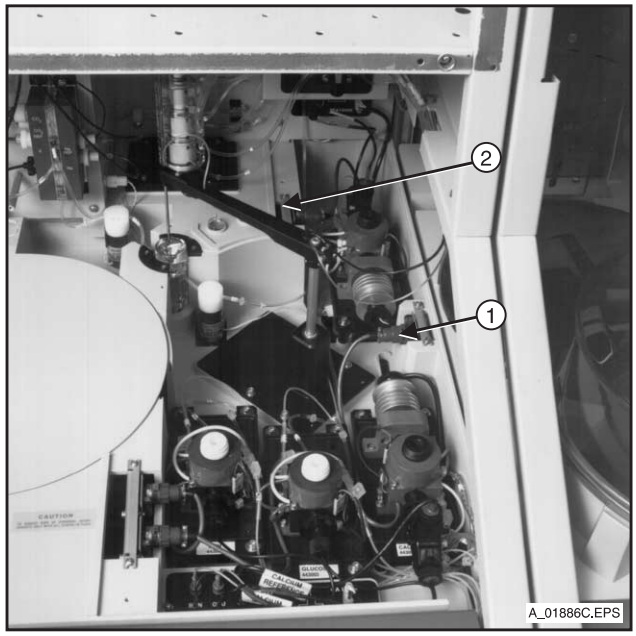
TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

14. Unscrew the three module retaining screws. There are two screws located at the rear of the calcium module and one at the front. The creatinine module has one screw at the rear of the module and two screws at the front.

WARNING

THE CONNECTOR PANEL MAY BE HOT. TO AVOID POSSIBLE BURNS, DO NOT TOUCH THE CONNECTOR PANEL.

15. Disconnect the heater cable from the connector panel (located to the left of the creatinine module or in back of the total protein or calcium module) (Figure 4-88). This may be done by turning the plastic backshell portion of the connector counterclockwise until loose, then turn the metal clamp until it releases from retainer clips. You may need to use a screwdriver. Pull connector straight out until pins disengage.

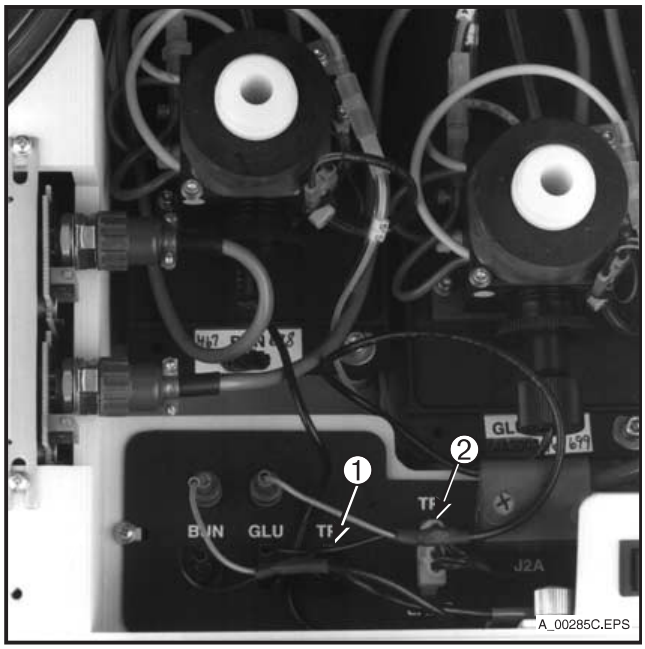


1 - Total Protein (or Calcium) Heater Cable
2 - Creatinine Heater Cable

Figure 4-88. Disconnect Heater Cable

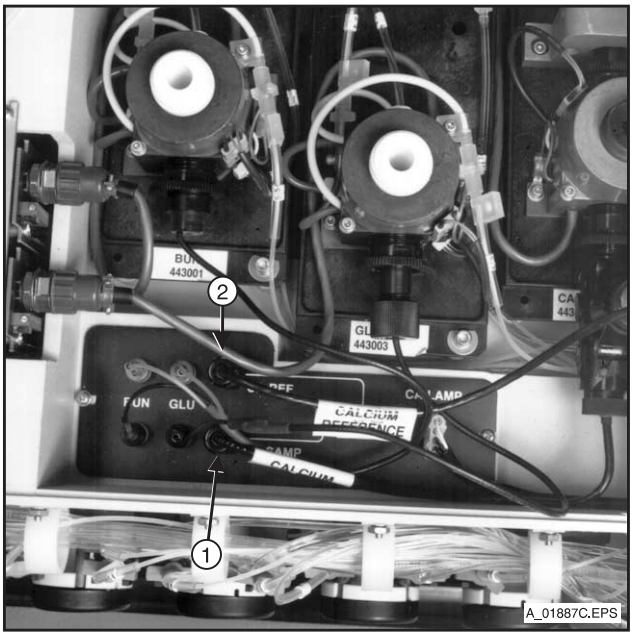
16. Carefully remove all tubing attached to the cup assembly, lines #18, #17, and #52 for total protein or calcium, or lines #14, #13, and #51 for creatinine.

17. Disconnect the sample and reference detector cables from connector panel (Figure 4-89). The panel is located in front of the total protein or calcium module or behind the creatinine module.



A. Total Protein Detector Cables

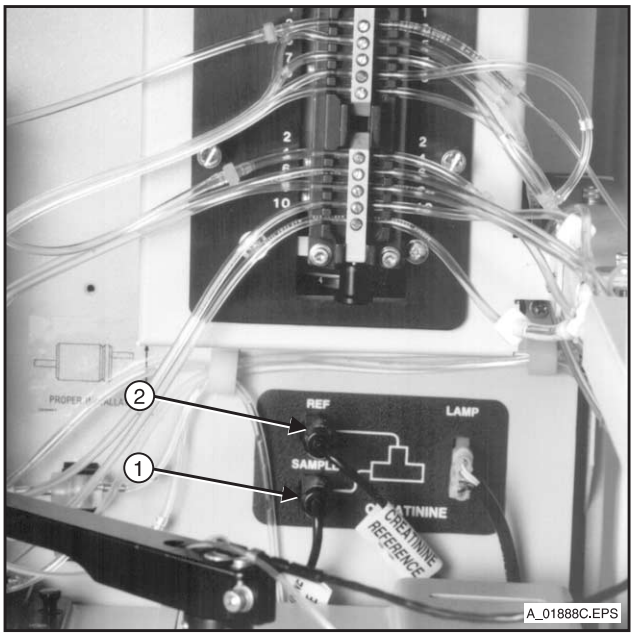
1 - Detector Cable
2 - Lamp Cable



B. Calcium Detector Cables

1 - Sample
2 - Reference

Figure 4-89. Disconnect Sample and Reference Detector Cables



C. Creatinine Detector Cables

1 - Sample
2 - Reference

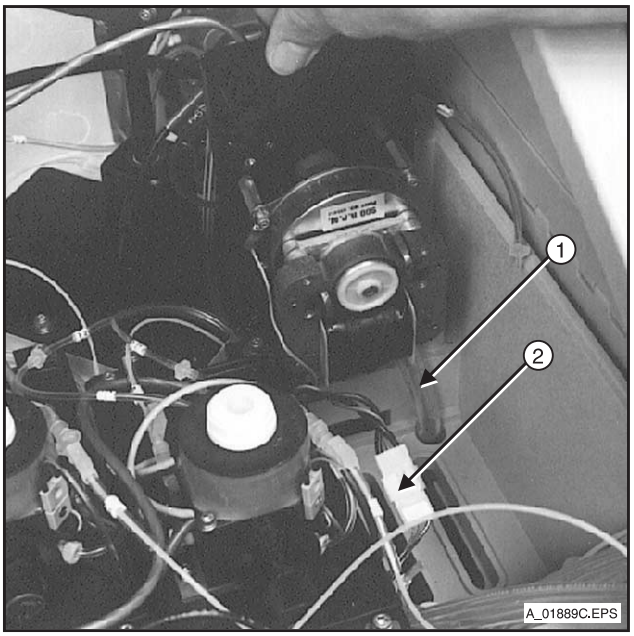
Figure 4-89. Disconnect Sample and Reference Detector Cables

18. Disconnect the lamp cable from connector panel (Figure 4-89). This panel is located in front of the total protein (or calcium) module or behind the creatinine module.

19. Lift module to expose large drain tubing attached to the underside and the mixer cable extending from the module (Figure 4-90).

NOTE

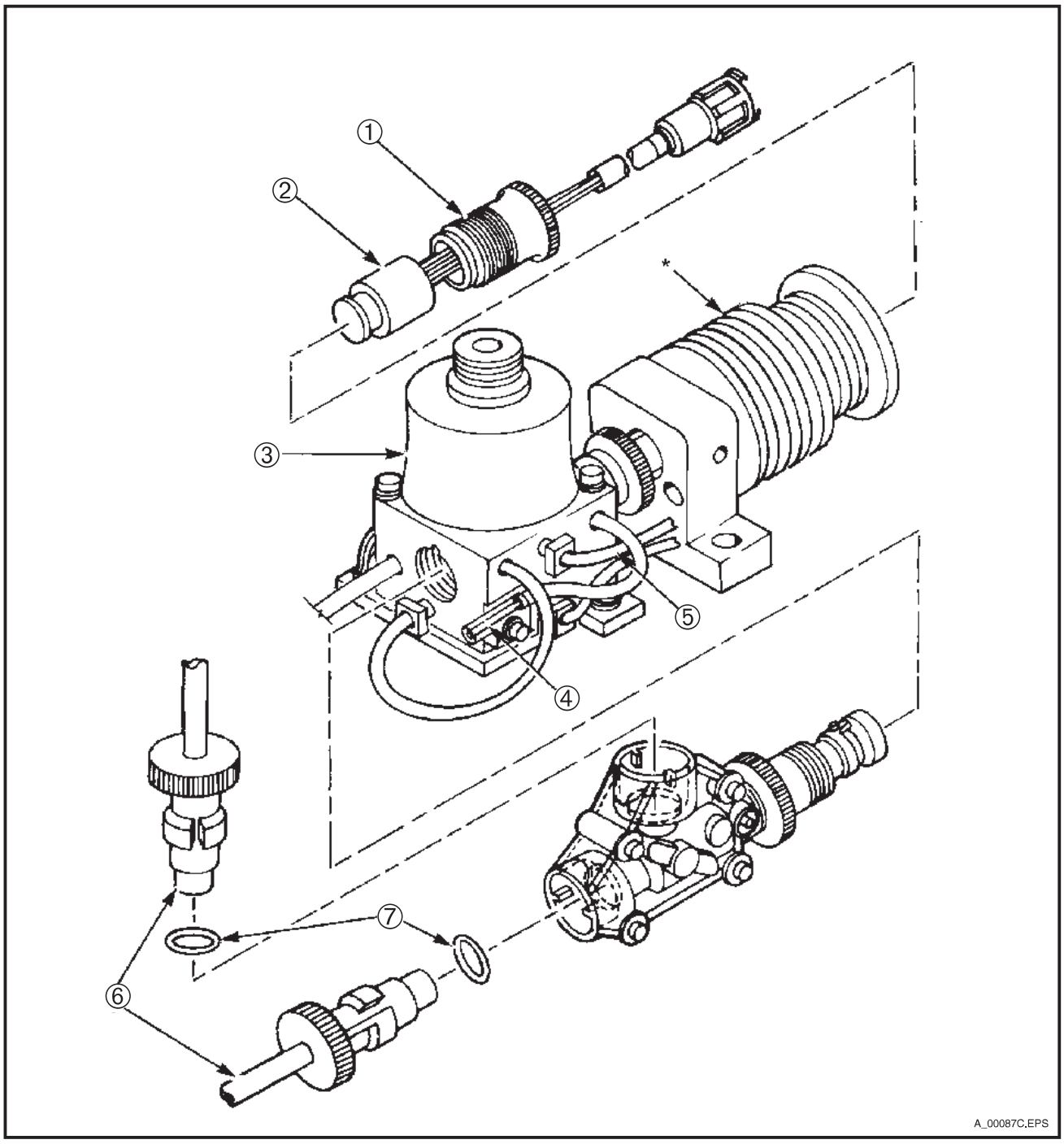
Take care not to allow drain tubing and cable to fall down inside of the system, as retrieval may be difficult.



1 - Large Drain Tube
2 - Mixer Cable

Figure 4-90. Removing Total Protein (or Calcium) and Creatinine Module

20. Disconnect drain tubing and mixer cable (Figure 4-90).
21. Remove module from system.
22. Install new stirrer in new module.
23. Remove REFERENCE detector (Figure 4-91A) from old module and install in new module. (There is no reference detector for total protein).



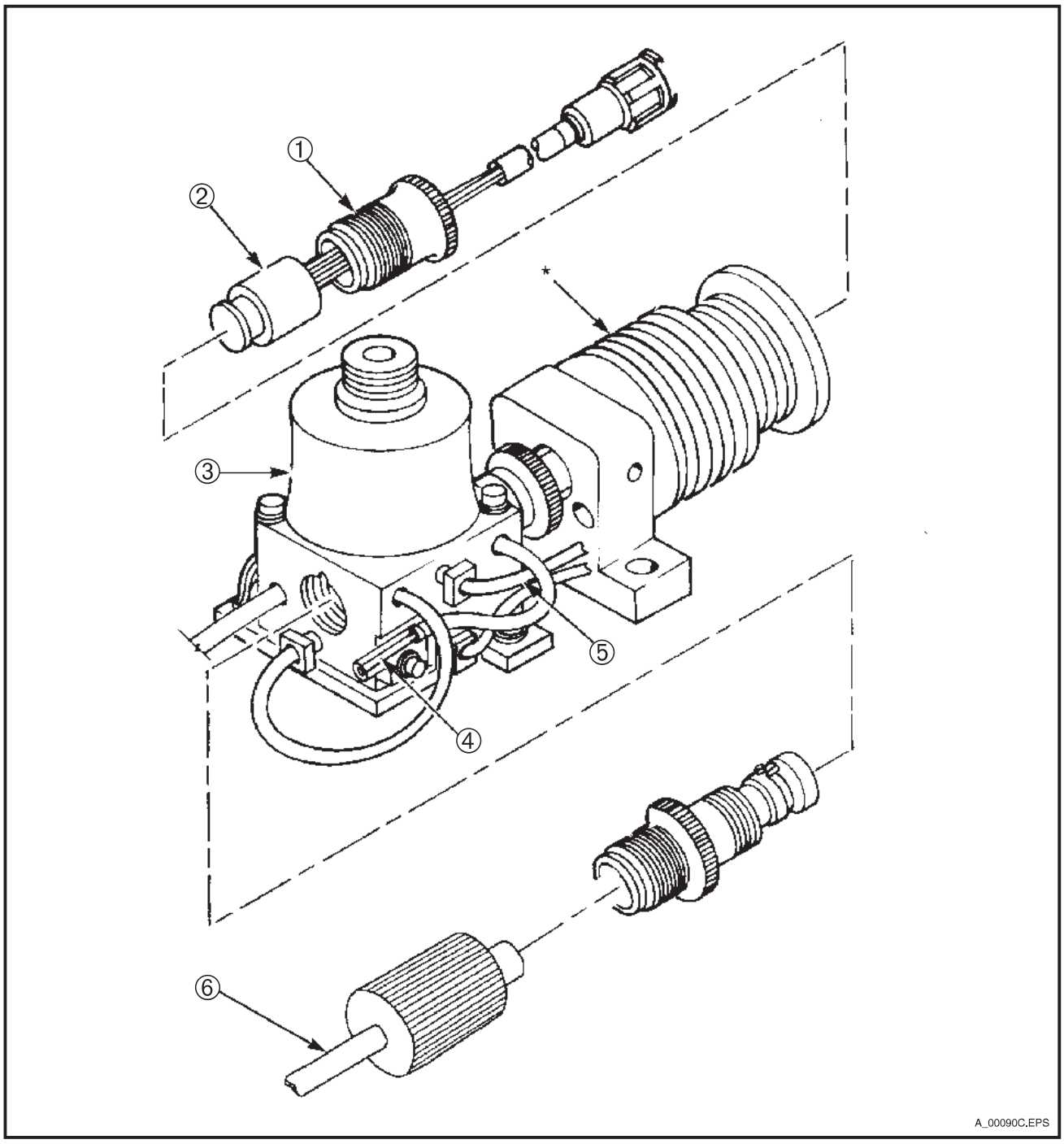
1 - Source Lamp Retaining Nut
2 - Source Lamp Assembly
3 - Reagent Preheater
4 - Reagent In-Connector
5 - Sip Line
6 - Photodetector Assemblies
7 - O-Ring

***CAUTION**

DO NOT disassemble this portion of optical system as misalignment could result.

A

Figure 4-91. Calcium and Creatinine Reaction Cup Assembly.



1 - Source Lamp Retaining Nut
2 - Source Lamp Assembly
3 - Reagent Preheater
4 - Reagent In-Connector
5 - Sip Line
6 - Photodetector Assemblies

***CAUTION**

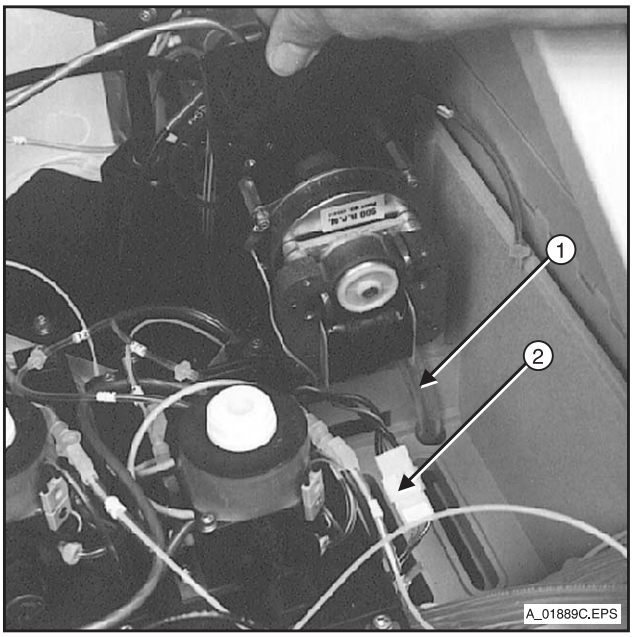
DO NOT disassemble this portion of optical system as misalignment could result.

B

Figure 4-91. Total Protein Reaction Cup Assembly.

24. Remove SAMPLE detector (Figure 4-91A or 4-91B) from old module and install in new module.

25. Connect mixer cable to new module (Figure 4-92).



1 - Large Drain Tube
2 - Mixer Cable

Figure 4-92. Connect Mixer Cable

26. Attach large drain tube to bottom of new module (Figure 4-92).

27. Install new module. Take care not to pinch any lines or tubing.

28. Connect all tubing, lines #18, #17, and #52 for total protein or calcium, and lines #14, #13, and #51 for creatinine.

29. Install the three module retaining screws and tighten until snug (Figure 4-93).

Figure 4-93. Install Module Retaining Screws

30. Connect the lamp and detector cables to their respective connector panel (Refer to Figure 4-89).

31. Connect the heater cable to connector panel (Refer to Figure 4-88).

32. Reconnect system power cord to power source.

33. Press MAIN system power switch to the ON position.

    (a) Turn the PC console ON using the switch on the front of the console unit.

34. Prime total protein (or calcium) or creatinine three times. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type 1 and **ENTER**.

    (c) Cursor and **SELECT** CRE3 or TP3 (or CA3).

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type **3** and press **ENTER**. The display indicates the number of primes remaining.

35. While module is priming, observe lines and chemistry reaction cup to determine if there are any leaks. Stop the priming if any leaks are noticed and correct the problem.

36. Observe stirrer to verify that it is rotating properly.
37. Press **PREV SCREEN** to return to Special Functions Screen.
38. Program the system as follows:
    (a) From the Special Functions Screen, cursor and **SELECT** 6. Maintenance Procedures or type **6** and **ENTER**.
    (b) Cursor and **SELECT** 5. CX3 Sample Probe Maintenance or type **5** and **ENTER**. The sample probe arm will rotate away from the electrolyte injection cup.
    (c) Replace the rear shield located over the creatinine chemistry reaction cup. Be careful not to pinch wires or tubes under the cover.
    (d) Press **PREV SCREEN** to home probe.
39. Replace front chemistry cup shield over BUN, glucose, and total protein (or calcium) reaction cups. Be careful not to pinch wires or tubes under the cover.
40. Replace and secure the four retaining nuts and three thumb screws on the front and rear shields.

NOTE

When reinstalling chemistry reaction cup module, be sure to properly align module with the sample probe. This will prevent any damage from occurring to the sample probe or reaction cup.

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.12 CX3 MODULE CIRCUIT BOARD REPLACEMENT

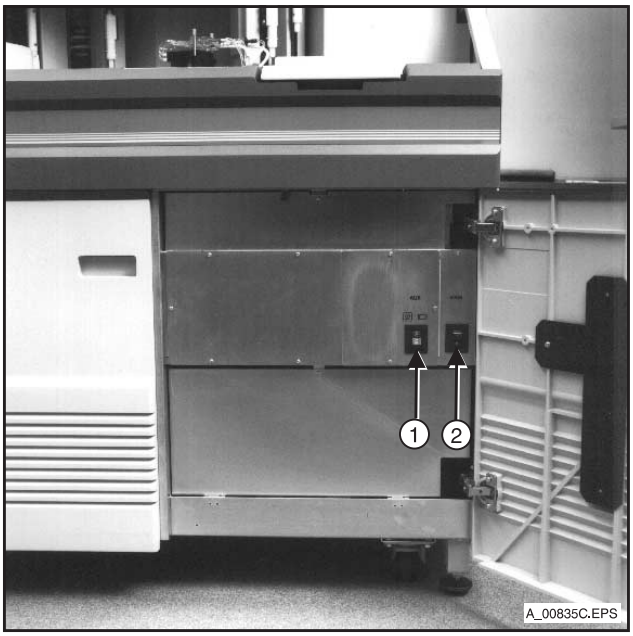
For instructions on circuit board removal and replacement, refer to Paragraph 4.4.

4.13 CIRCUIT BREAKER

4.13.1 Power Supply Compartment Circuit Breakers

1. If a circuit breaker in the power supply compartment should trip, reset it using the following procedure.
2. From the MASTER Screen, press **SYS IDLE**. The screen will prompt: “Continue with the shut down procedure (Y/N)?”
3. Press **Y**, then **ENTER**. The screen will display:

   “SYSTEM IDLE” “CX3: STANDBY”
   “CONSOLE: “ “CX4: STANDBY”
4. Press **F4 RESUME**. The screen will prompt: “This will reboot the system. Continue with the Resume procedure?”
5. Press **Y**, then **ENTER**. The message display window will prompt: “Press <**PREV SCREEN**> to continue” (flashing message).
6. Press **PREV SCREEN**. A window will pop up giving four boot options.
7. Press **1**. A red “**POWER DOWN SCREEN**” will prompt you to: “Turn off CX Instrument and/or PC Console Power Now.”
    (a) Turn the PC console power OFF using the switch on the front of the console unit.
8. Press MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-94). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-94. Power Switch

9. Before proceeding...

WARNING

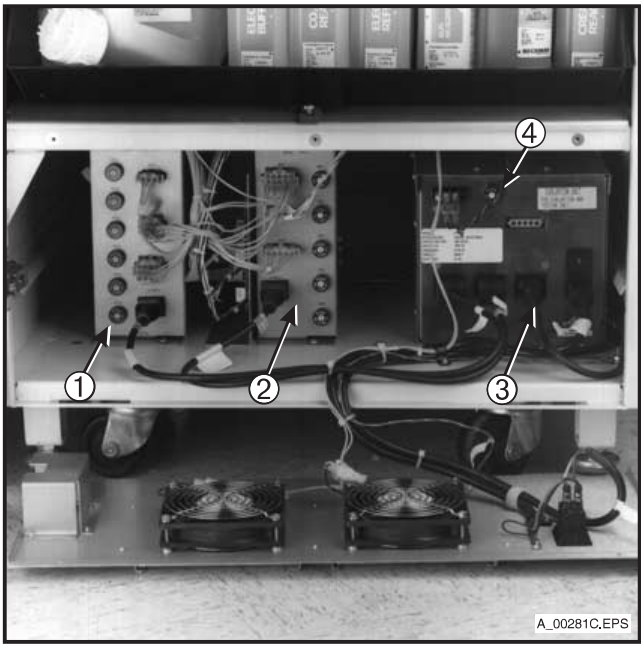
TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

10. Open the lower left door on the front of the system. Loosen the retaining screws located on the power supply cover (Figure 4-95). Pull out on the top of the cover, then lift cover off.

1 - Retaining Screws

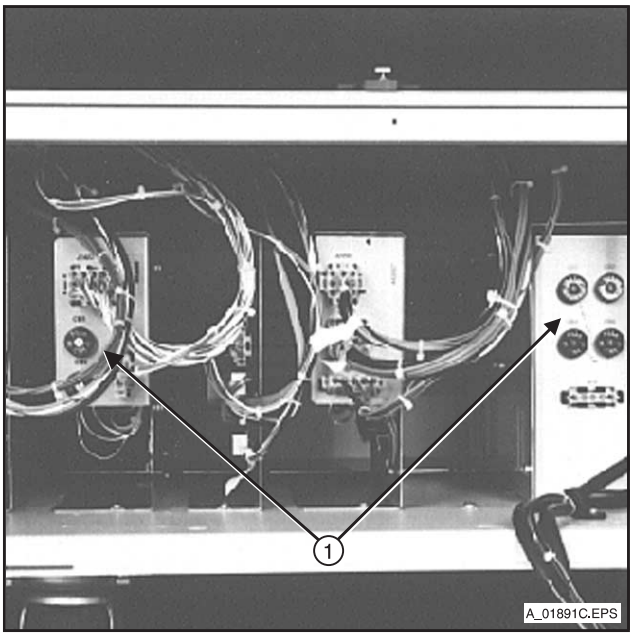
Figure 4-95. CX3 Power Supply Cover

11. Circuit breakers are located in the power supply compartment (Figure 4-96A or 4-96B).



A

Figure 4-96. Power Supply Circuit Breakers (CX7 DELTA)



B

1 - Circuit Breakers (shape may vary depending on system)

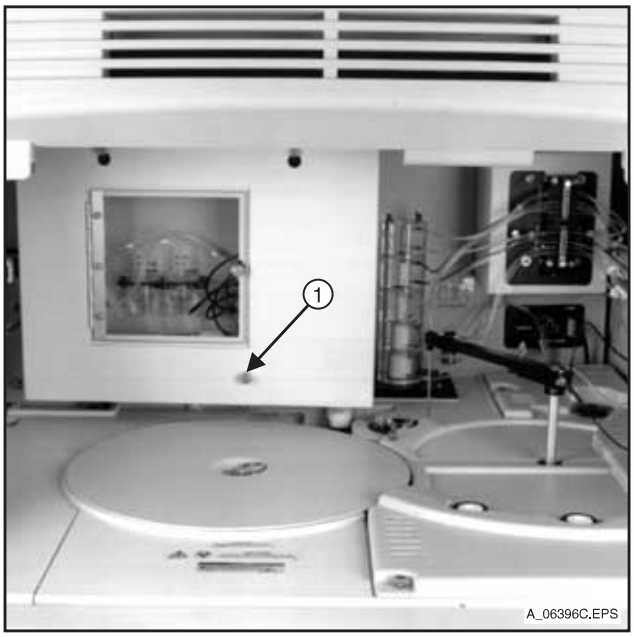
Figure 4-96. Power Supply Circuit Breakers (non CX7 DELTA)

12. If a circuit breaker should trip, reset it by pressing the button at the center of the circuit breaker or press the upper portion of the rocker button fully in, as appropriate (Figure 4-96A or 4-96B).
13. Replace the cover on the front of the power supply compartment and tighten both retaining screws.
14. Reconnect system power cord to power source.
15. Press system MAIN power switch to ON position.
16. Turn the PC console ON using the switch on the front of the console unit.
17. If the circuit breaker trips again, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.13.2 Sample Analysis Compartment Circuit Breakers (non CX7 DELTA instruments only)

Six circuit breakers are found behind the flow cell cover in the sample analysis compartment. If a circuit breaker should trip, its corresponding green light will be off.

1. Remove the flow cell cover by removing the captive screw located at the bottom of the flow cell cover (Figure 4-97). Grasp the cover and carefully lift up and over the two remaining guide screws. Set cover aside.



1 - Captive Screw

Figure 4-97. Flow Cell Cover

2. From the MASTER Screen, press **SYS IDLE**. The screen will prompt: “Continue with the shut down procedure (Y/N)?”
3. Press **Y**, then **ENTER**. The screen will display:

“SYSTEM IDLE”	“CX3: STANDBY”
“CONSOLE: “	“CX4: STANDBY”

4. Press **F4 RESUME**. The screen will prompt: “This will reboot the system. Continue with the Resume procedure (Y/N)?”
5. Press **Y**, then **ENTER**. The message display window will prompt: “Press <**PREV SCREEN**> to continue” (flashing message).
6. Press **PREV SCREEN**. A window will pop up giving four boot options.

7. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn off CX Instrument and/or PC Console Power Now."

   (a) Turn the PC console power OFF using the switch on the front of the console unit.

8. Press MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-94). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.

9. Before proceeding...

WARNING

TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

10. Reset circuit breaker by pressing the button at the center of the circuit breaker (Figure 4-98).

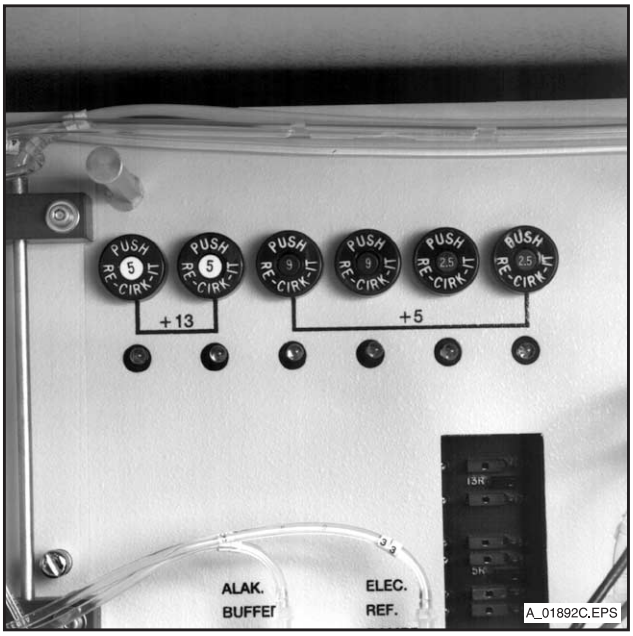


Figure 4-98. Circuit Breaker

11. Reconnect system power cord to power cord to power source.

12. Press system MAIN power switch to the ON position.

13. Turn the PC console power ON using the switch on the front of the console unit.

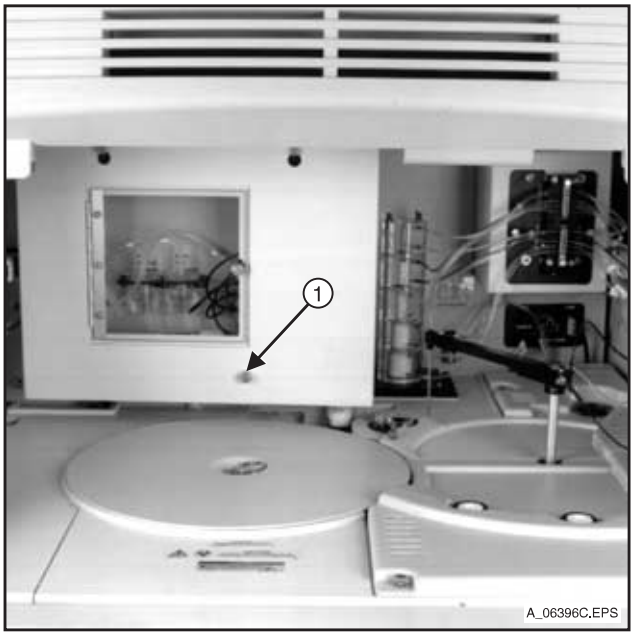
14. If the circuit breaker trips again, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.14 DAMPER ASSEMBLY REMOVAL AND REPLACEMENT

The damper assemblies regulate the flow pressure of the alkaline buffer and electrolyte reference reagent to the CO_2 electrodes and the sodium reference electrode.

To access the damper assemblies:

Remove the flow cell cover by removing the captive screw located at the bottom of the flow cell cover (Figure 4-99). Grasp the cover and carefully lift up and over the two remaining guide screws. Set cover aside.

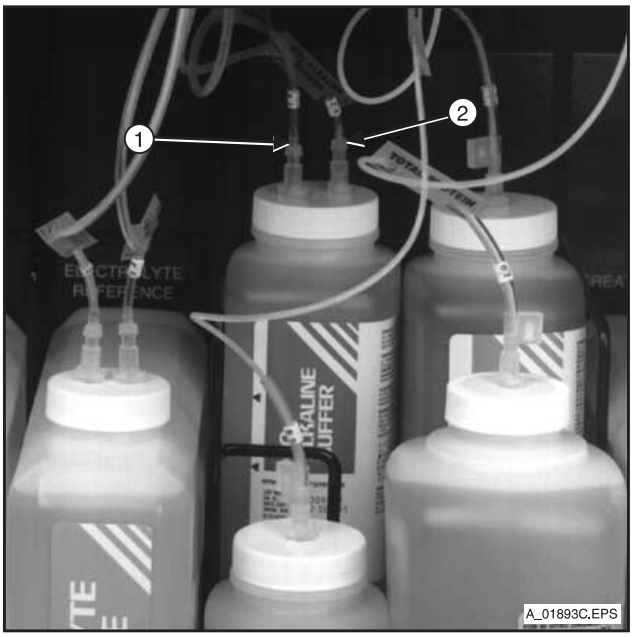


1 - Captive Screw

Figure 4-99. Flow Cell Cover

4.14.1 CO_2 Alkaline Buffer Damper

1. Remove reagent line #81 from the alkaline buffer reagent bottle (Figure 4-100).



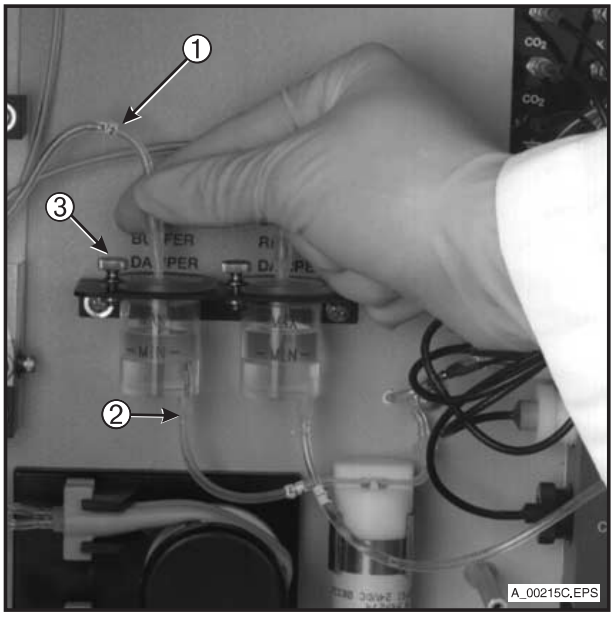
1 - Line #81
2 - Line #82

Figure 4-100. Remove Reagent Line from Alkaline Buffer

NOTE

Do not remove line #82 from the alkaline buffer reagent bottle. This line returns alkaline buffer reagent to the bottle. Removing it could cause a reagent spill when the system is primed.

2. Prime the alkaline reagent ten times to empty damper and lines. Program the system as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** CO_2 Alkaline Buffer.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type 10 and press **ENTER**. The display indicates the number of primes remaining.
3. After priming is complete, assure the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.
4. Ensure damper is empty. Remove input line #32 from top of damper and output line #77 from bottom of damper (Figure 4-101) by firmly grasping damper with one hand, pull lines off using a twisting motion with other hand.



1 - Line #32
2 - Line #77
3 - Thumbscrew

Figure 4-101. Remove Input and Output Lines from Damper

5. Remove retaining thumbscrew (Figure 4-101) and lift damper from mounting bracket.
6. Place a new damper assembly onto mounting bracket.
7. Screw retaining thumbscrew (clockwise) until finger-tight to secure damper.
8. Connect input line #32 to top and output line #77 to bottom of damper.
9. Connect reagent line #81 to alkaline buffer reagent bottle.
10. Press **PREV SCREEN** to conclude this procedure. Allow system to reinitialize. Press **MASTER SCREEN**.

11. Prime the alkaline buffer reagent 10 times. While the system is priming, check for leaks. Stop the priming if any leaks are noticed and correct the problem.

12. If damper assembly is not one-half full with alkaline buffer reagent upon completion of prime cycles in Step 11, perform the following steps:

    (a) Grasp input line #32 connector. Lift line slightly, leaving only the input straw extended into the damper assembly.

NOTE

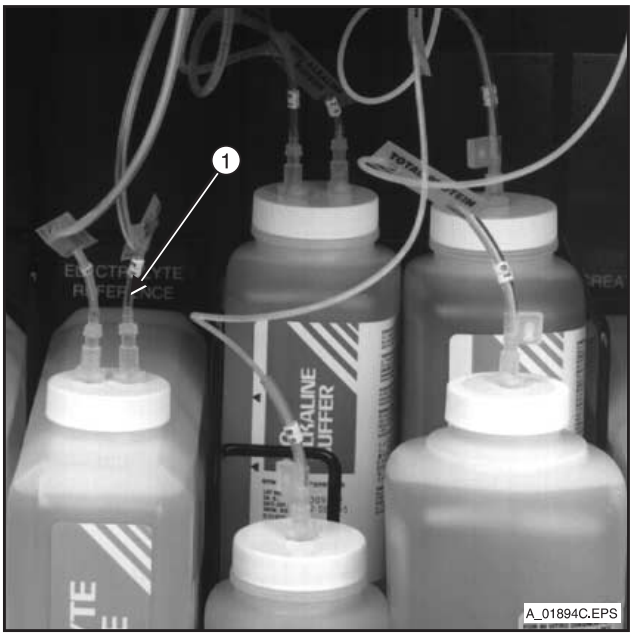
If input straw is not fully extended into the damper, a reagent spill may occur in Step (b) of this procedure.

    (b) Turn the alkaline buffer peri-pump counterclockwise until the damper is at least one half full.

    (c) Connect input line #32 to damper assembly when the damper is one-half full with alkaline buffer reagent.

4.14.2 Electrolyte Reference Damper

1. Remove reagent line #83 from the electrolyte reference reagent bottle (Figure 4-102).



1 - Line #83

Figure 4-102. Removing Reagent Bottle Lines

2. Prime the electrolyte reference reagent twenty times to empty the lines. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** Electrolyte Reference.

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type 20 and press **ENTER**. The display indicates the number of primes remaining.

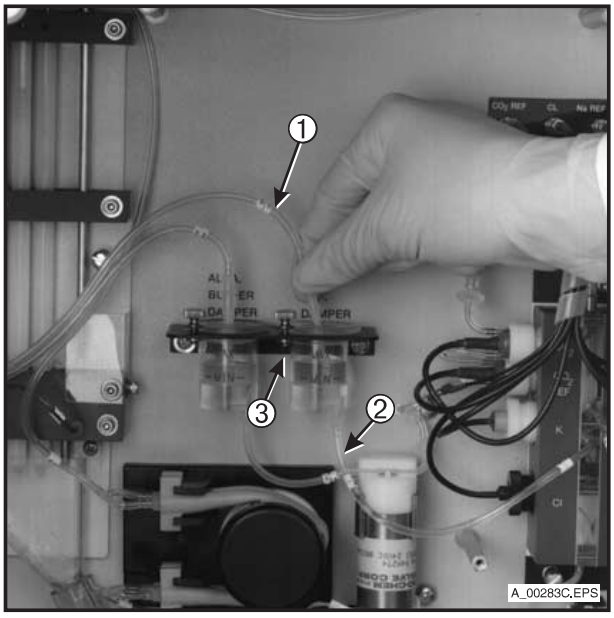
3. After priming is complete, assure the system is in STANDBY, then prevent the system from autopriming as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.

    (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.

4. Using a hemostat, securely clamp output line #74 approximately one inch (25mm) from the bottom of the damper (Figure 4-103). This will prevent the backflow of reagents into the flow cell.



1 - Line #33 (input)
2 - Line #74 (output)
3 - Thumbscrew

Figure 4-103. Electrolyte Reference Damper

5. Remove input line #33 from top of damper and output line #74 from bottom of damper (Figure 4-103) by firmly grasping the damper with one hand and pulling lines off using a twisting motion with the other hand.
6. Remove retaining thumbscrew (Figure 4-103) and lift damper from mounting bracket.
7. Place the new damper assembly onto the mounting bracket.
8. Screw retaining thumbscrew (clockwise) until finger-tight.
9. Connect input line #33 to top of damper and output line #74 to bottom.
10. Connect reagent line #83 to electrolyte reference reagent bottle.
11. Remove hemostat from bottom of damper.
12. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
13. Prime the electrolyte reference reagent 30 times. While the system is priming check for leaks. Stop the priming if any leaks are noticed and correct the problem. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Electrolyte Reference.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **30** and press **ENTER**. The display indicates the number of primes remaining.
14. If damper assembly is not one-half full with electrolyte reference reagent upon completion of prime cycles in Step 13, perform the following steps:
    (a) Grasp input line #33 connector. Lift line slightly, leaving only the input straw extended into the damper.

NOTE

If input straw is not fully extended into the damper, a reagent spill may occur in Step (b) of this procedure.

    (b) Turn the electrolyte reference peri-pump counterclockwise 5 times or until the damper is at least one-half full.
    (c) Connect input line #33 to damper assembly when the damper is one-half full with electrolyte reference reagent.

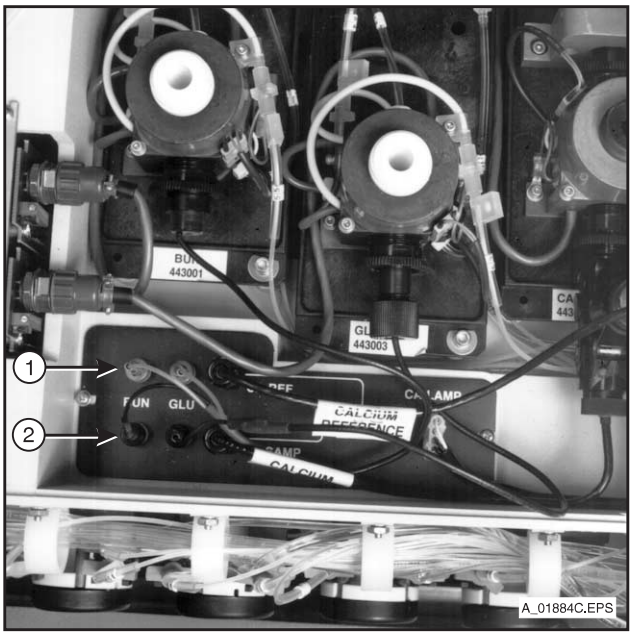
4.15 ELECTRODE REPLACEMENT

4.15.1 BUN Electrode Removal and Replacement

Plan to allow 15 minutes for the electrode to achieve temperature stability following this procedure.

1. Remove the front shield over the BUN, glucose and total protein (or calcium) chemistry reaction cups as follows:
    (a) Unscrew and remove the front three retaining nuts and one thumb screw.
    (b) Gently lift shield off.
2. Prepare chemistry reaction cup for maintenance as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 6. Maintenance Procedures or type **6** and **ENTER**.
    (c) Cursor and **SELECT** 6. CX3 Chemistry Maintenance or type **6** and **ENTER**.
    (d) Cursor and **SELECT** BUN3.
    (e) Press **F1 CONTINUE**. This will drain the cup of reagent so that maintenance may be performed.

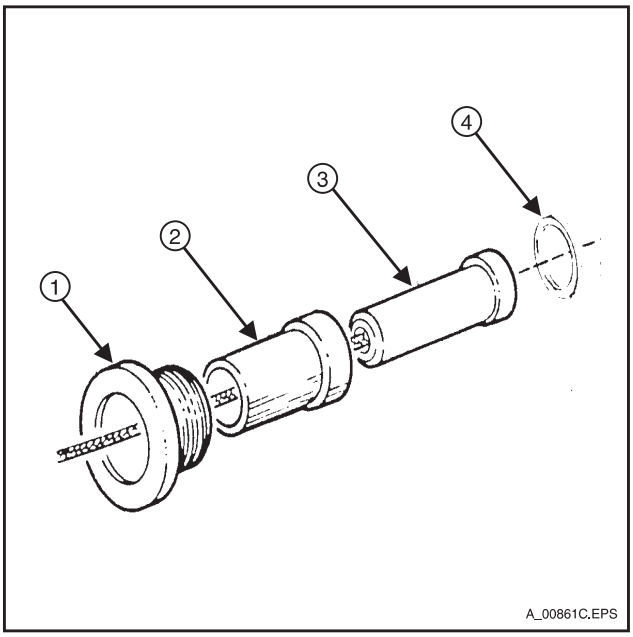
3. Disconnect red and black BUN pin leads from connector panel (Figure 4-104).



1 - Red Pin Lead
2 - Black Pin Lead

Figure 4-104. BUN Pin Leads.

4. Unscrew BUN electrode retainer nut and withdraw electrode-retainer assembly from chemistry reaction cup (Figure 4-105).



1 - Retainer Nut
2 - Electrode Retainer
3 - Electrode
4 - Quad-Ring

Figure 4-105. Disassembled BUN Electrode.

5. Inspect the electrode face to determine if it contains any scratches across the surface, especially in the area adjacent to the gap.
6. If electrode is scratched near the gap, it may need to be replaced.
7. To clean electrode, remove quad-ring from face of electrode (Figure 4-106).

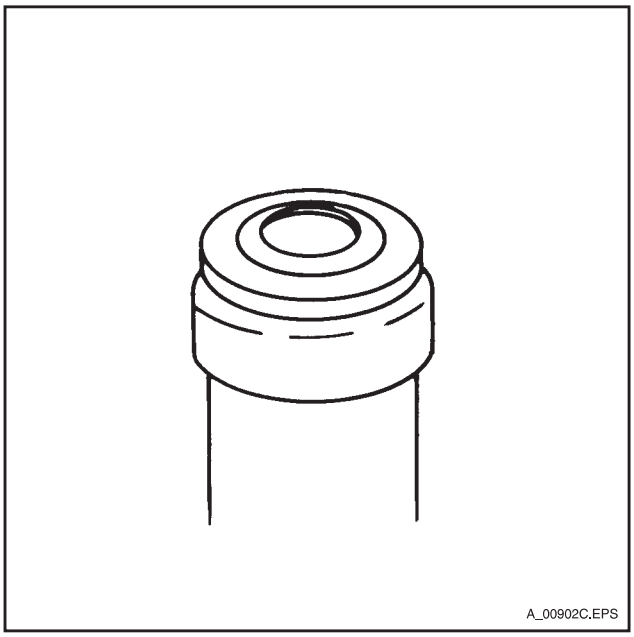


Figure 4-106. End View of BUN Electrode

CAUTION

Avoid scratching gold coating on face of electrode as excessive scratching may adversely affect performance.

8. Rinse quad-ring in deionized water and dry using lintless tissue.
9. Use lintless tissue moistened with 70% isopropanol to clean electrode face until gold surface is bright. Rub parallel to the gap with tissue. Rinse with deionized water. Dry using lintless tissue.
10. Apply thin coating of Silicone Compound (P/N 879049) over tip of electrode. Carefully wipe electrode end parallel to the gap with lintless tissue to remove all evidence of compound. Rub to a bright finish.
11. Reinstall quad-ring on face of electrode.
12. Reinstall retainer on BUN electrode (Refer to Figure 4-105).

13. Rotate electrode until electrode key enters retainer keyway.
14. Reinstall retainer nut on electrode-retainer assembly.
15. Align keyway on body of retainer containing electrode with key in electrode port and install electrode assembly. Finger-tighten retainer nut.
16. Reconnect red and black BUN pin leads into connector panel (Refer to Figure 4-104).
17. Press **PREV SCREEN**.
18. Prime as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** BUN3.
    (d) Operator is prompted to enter the number of prime cycles. Type **3** and press **ENTER**. The display indicates the number of primes remaining.
19. While module is priming, observe lines and chemistry reaction cup to determine if there are any leaks. Stop the priming if any leaks are noticed and correct the problem.
20. Observe stirrer to verify that it is rotating properly.
21. Carefully place shield over chemistry reaction cups. Take care that wires and tubes are not pinched under edges of cover.
22. Replace and secure the three retaining nuts and one thumb screw on the shield.
23. Close compartment door.

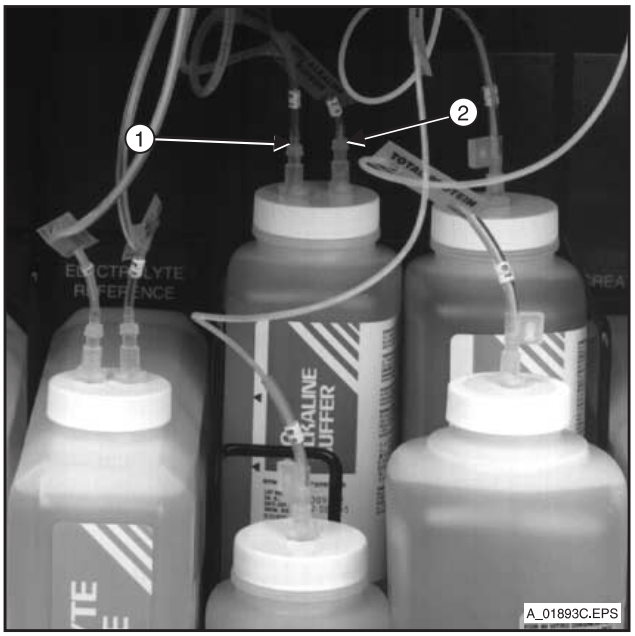
This completes the removal and replacement of the BUN electrode. Allow 15 minutes for temperature stability before calibration and operation of this module.

4.15.2 Carbon Dioxide Electrode Replacement

1. Remove reagent line #81 from the alkaline buffer reagent bottle.

NOTE

Do not remove the return line #82 from the alkaline buffer reagent bottle (Figure 4-107). Removing it could cause a reagent spill when the system is primed.

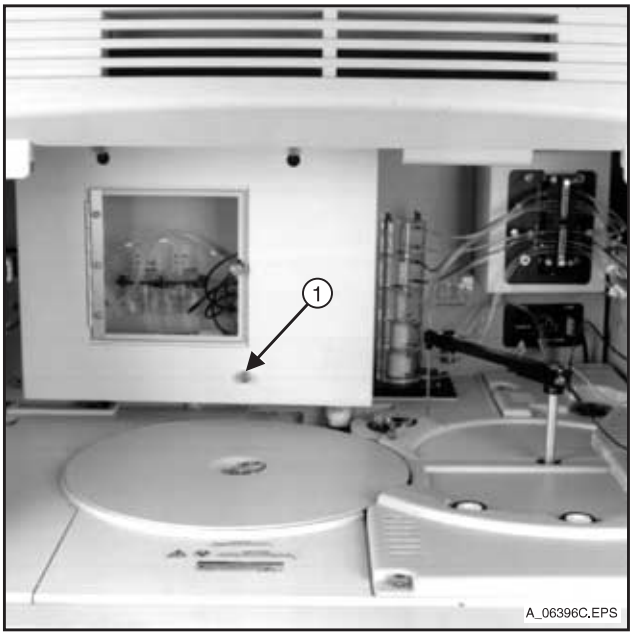


1 - Line #82 (reagent return line)
2 - Line #81 (alkaline buffer reagent line)

Figure 4-107. Alkaline Buffer Lines

2. Prime the alkaline buffer reagent 10 times to evacuate the lines. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Alkaline Buffer.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining.
3. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
    (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.

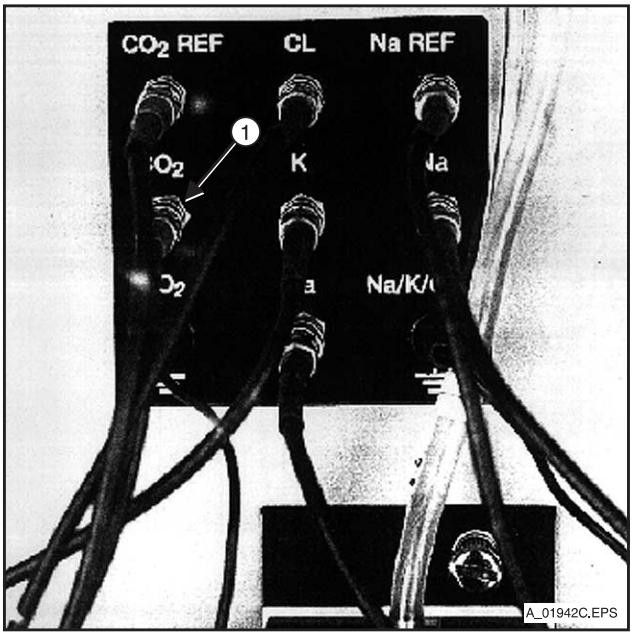
4. Remove the flow cell cover by first loosening the captive retaining screw (Figure 4-108). Grasp the cover and carefully lift up and over the two guide screws. Set cover aside.



1 - Captive Screw

Figure 4-108. Flow Cell Cover

5. Disconnect the CO_2 electrode cable (Figure 4-109).

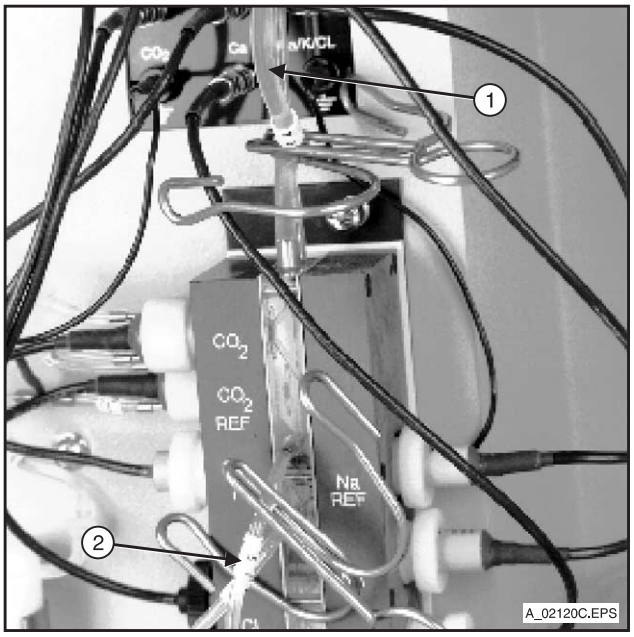


1 - CO_2 Electrode Cable

Figure 4-109. Disconnect CO_2 Electrode Cable.

6.

(a) Using a clamp, securely clamp the top front electrolyte drain tubing (line #71) approximately one inch (25 mm) from the top of the flow cell (Figure 4-110). This will prevent the backflow of reagent into the flow cell.



1 - Line #71, Electrolyte Drain Tubing
2 - Line #57, CO_2 Acid Tubing

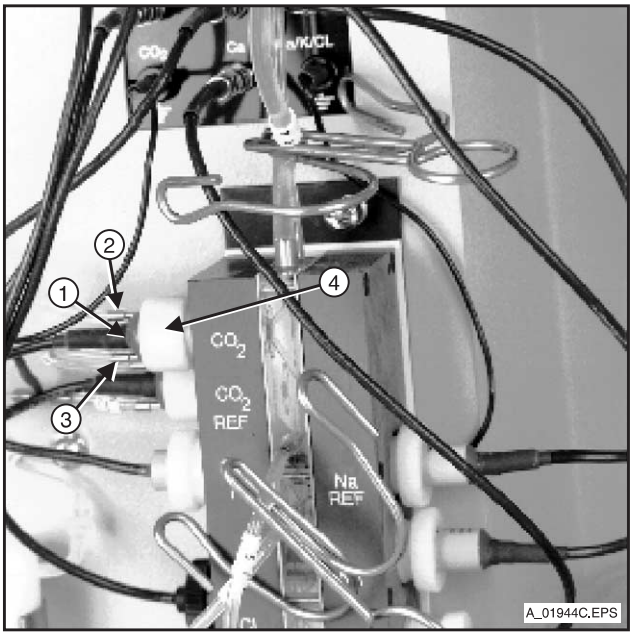
Figure 4-110. Flow Cell Assembly

(b) Using another clamp, clamp off the CO_2 acid tubing (line #57) on the front of the flow cell as close to the connector as possible (Figure 4-110). This will prevent acid flow into the flow cell.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from the flow cell solenoid valve.

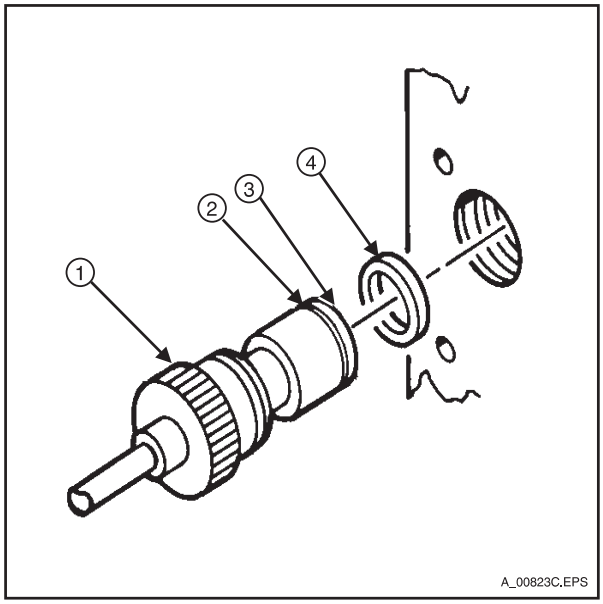
7. Locate the CO_2 electrode. Disconnect reagent lines labeled #80 and #78 from the electrode (Figure 4-111). Remove electrode by turning the electrode retainer nut counterclockwise.



1 - CO_2 Electrode
2 - line #80
3 - line #78
4 - retainer nut

Figure 4-111. CO_2 Electrode Placement on the Flow Cell

8. Remove the retainer nut from the old electrode.
9. Remove membrane as follows:
   (a) Pry off the membrane retainer assembly.
   (b) Remove the quad-ring from the retainer. Inspect the electrode port if the quad-ring is not on the electrode.
   (c) Separate membrane retainer and membrane clamp (Figure 4-112). Discard used membrane.



1 - Retainer Nut
2 - Membrane Clamp
3 - Membrane Retainer
4 - Quad-Ring

Figure 4-112. CO_2 Measuring Electrode.

10. With tweezers remove new membrane (Beckman P/N 661750) from package contained in the CX3 Module Maintenance Kit. Rinse membrane thoroughly in deionized water to remove all traces of dry powder (Figure 4-113). Dry the membrane using lintless tissue. Discard excess paper membrane spacers.

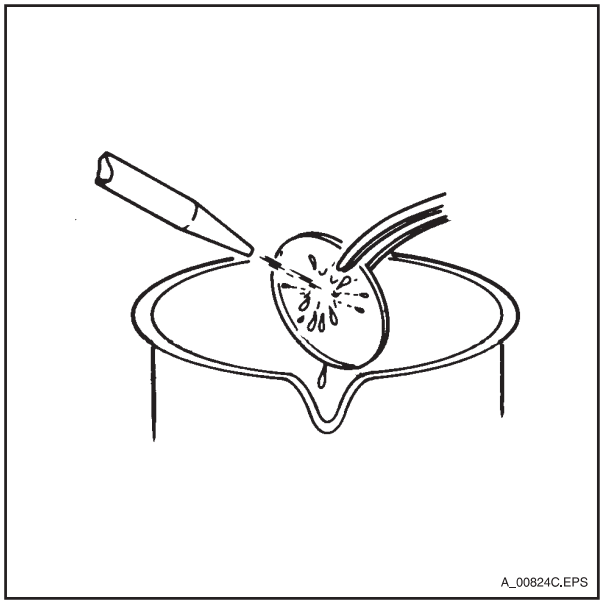
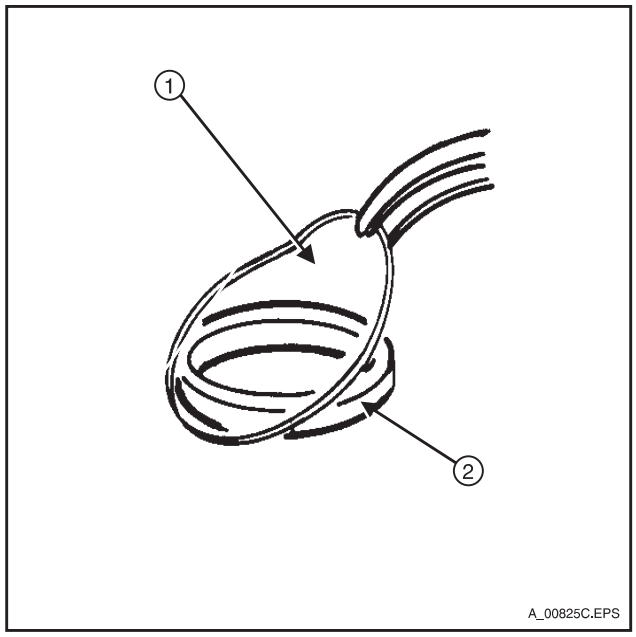


Figure 4-113. Rinsing the Membrane with Deionized Water.

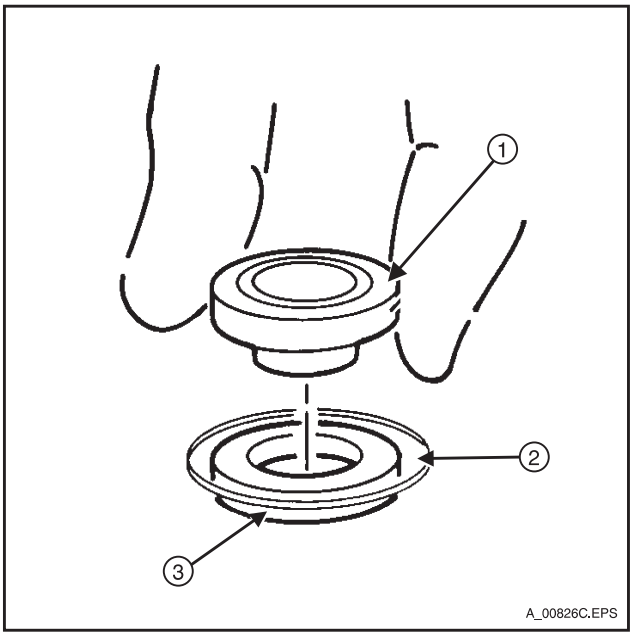
11. Place the membrane clamp on a flat surface. Using tweezers, carefully center the membrane on top of the membrane clamp (Figure 4-114).



1 - Membrane
2 - Clamp

Figure 4-114. CO_2 Membrane Placement.

12. Center the membrane retainer over the membrane clamp. Press the membrane retainer into the clamp, thus securing the membrane (Figure 4-115).



1 - Retainer
2 - Membrane
3 - Clamp

Figure 4-115. Securing the CO_2 Membrane.

13. Place the retainer assembly upside down on the work surface so the clamp is on top and retainer on bottom. Grasp the electrode carefully and press it firmly against the membrane and into the membrane clamp (Figure 4-116).

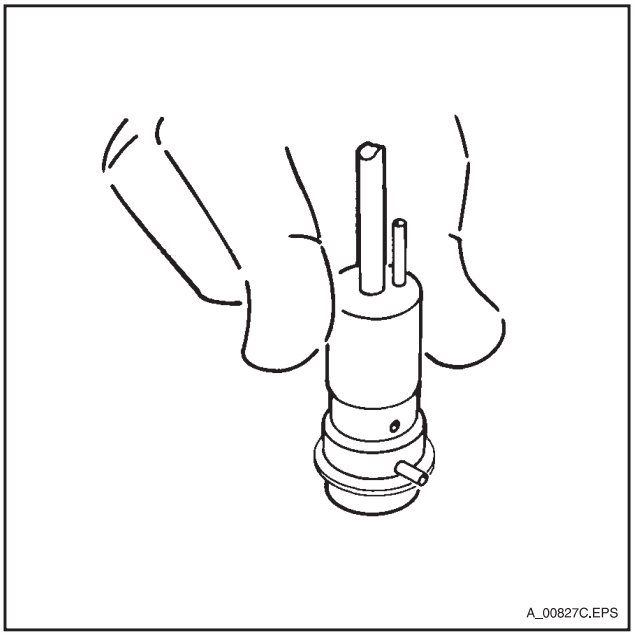
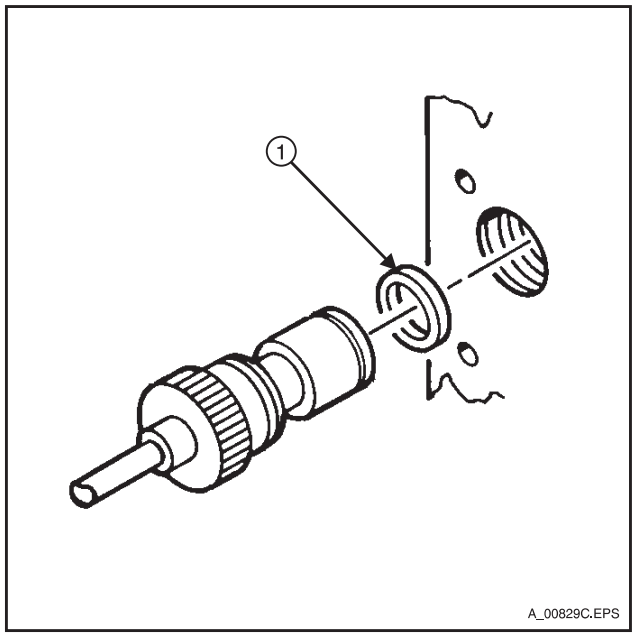


Figure 4-116. Securing the Membrane Retainer.

14. Inspect the membrane to verify that it is not torn, punctured or wrinkled and is centered properly. If membrane is not centered correctly or is damaged, repeat Steps 9 through 14.
15. Reinstall new quad-ring onto the membrane retainer (Figure 4-117). When installed, the quad-ring must be on the very end of the CO_2 electrode. This ensures a proper fluid seal when the electrode is installed in the flow cell.



1 - Quad-Ring

Figure 4-117. Reinstallation of Quad-Ring.

CAUTION

Do not touch membrane surface when installing the quad-ring as damage to the membrane may result.

16. Using a lint-free tissue, carefully dry the electrode assembly and electrode port to remove all traces of moisture.

NOTE

Electrode and electrode port must be completely dry before reinstalling electrode.

17. Insert the new CO_2 electrode into electrode port. Be careful to align key on electrode with keyway in the electrode port.
18. Insert retainer nut and turn clockwise until finger-tight.
19. To test for proper seating of electrode, gently pull on electrode body (Figure 4-118). The electrode assembly should not move. If the electrode moves, remove it and try to reinstall. Check for an extra or missing quad-ring if installation is difficult. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

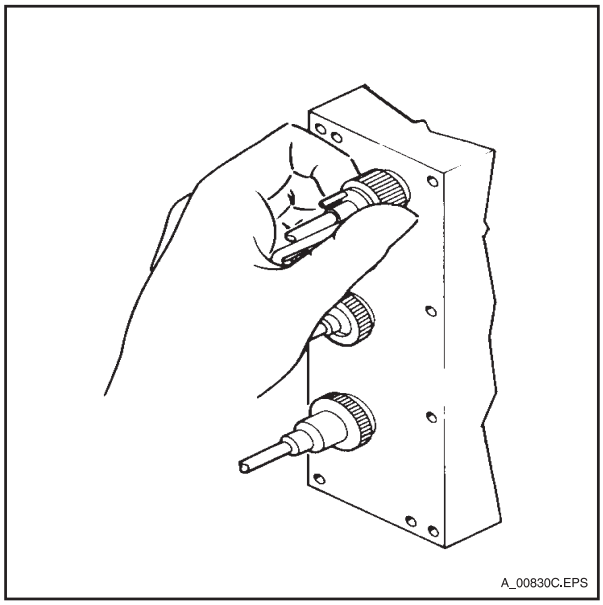
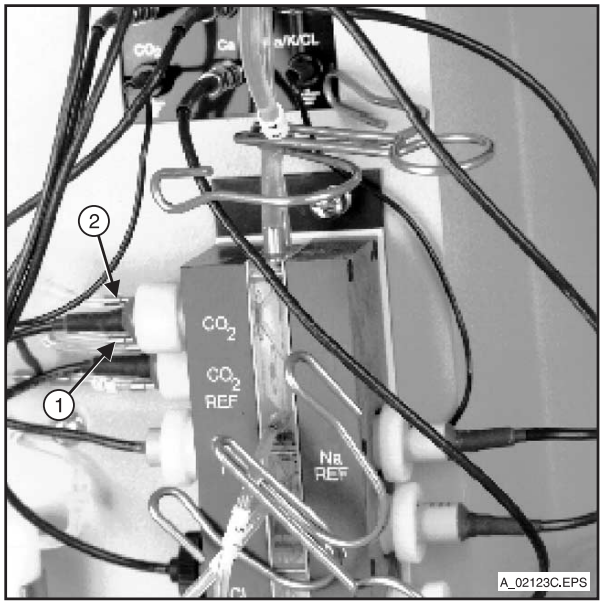


Figure 4-118. Testing for Proper Seating of CO_2 Electrode.

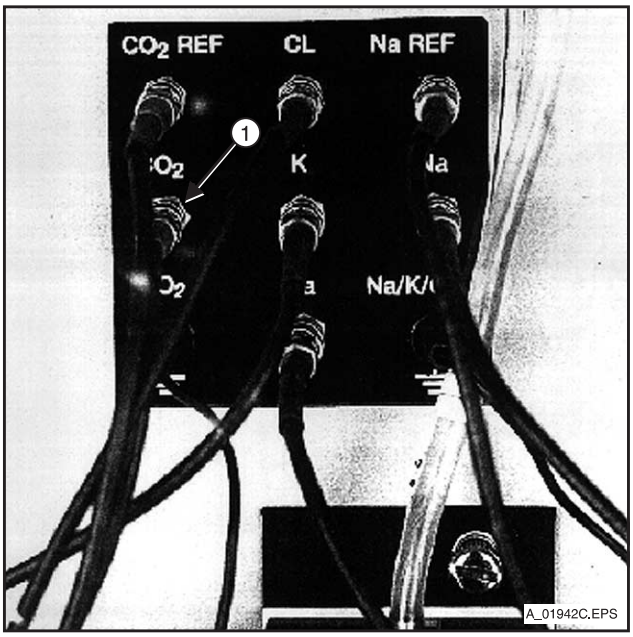
20. Reconnect tubing lines labeled #78 and #80 to the electrode (Figure 4-119).



1 - Line #78
2 - Line #80

Figure 4-119. Reconnect Tubing to CO_2 Electrode

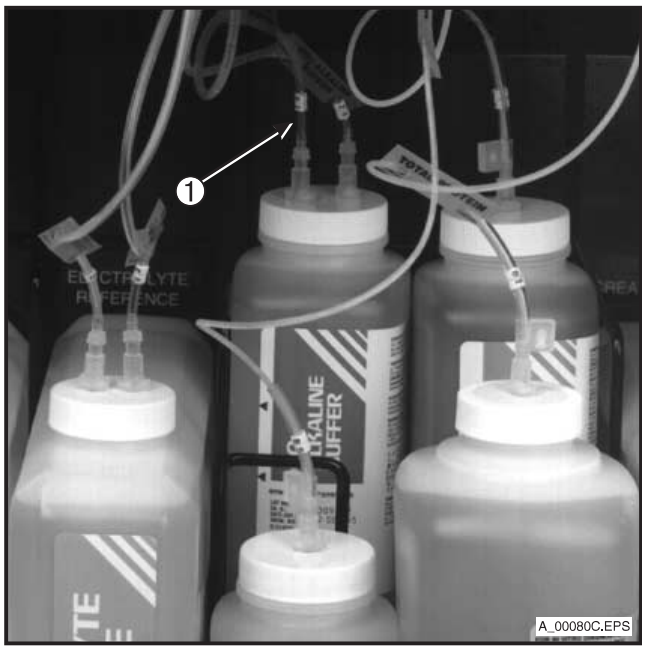
21. Reconnect electrode cable to the appropriate connector (Figure 4-120).



1 - CO_2 Electrode Cable

Figure 4-120. Reconnect Electrode Cable

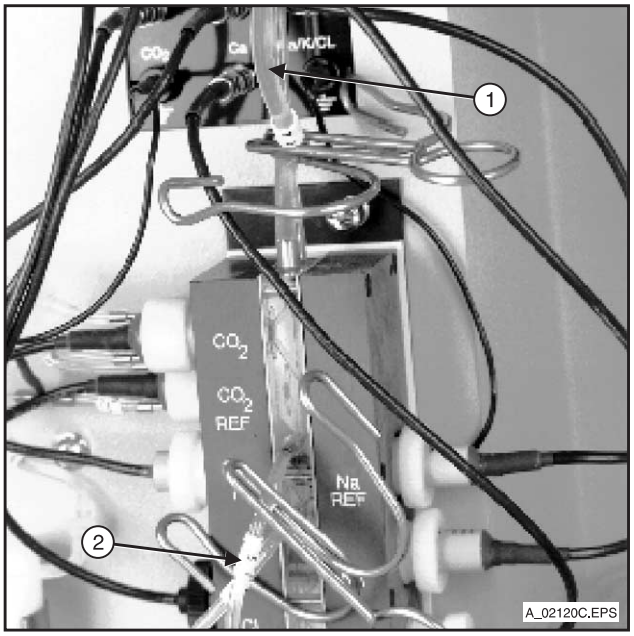
22. Reconnect reagent line #81 to the alkaline buffer reagent bottle (Figure 4-121).



1 - Line #81

Figure 4-121. Reconnect Reagent Line #81

23. Remove clamps from top front electrolyte drain and CO_2 acid tubing (Figure 4-122).



1 - Line #71, Electrolyte Drain Tubing
2 - Line #57, CO_2 Acid Tubing

Figure 4-122. Remove Clamps from Line #71 and Line #57

24. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.

25. Prime CO_2 alkaline buffer reagent 15 times. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** Alkaline Buffer.

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type **15** and press **ENTER**. The display indicates the number of primes remaining. While system is priming observe flow cell for leaks. Stop priming if any leaks are noticed and correct problem.

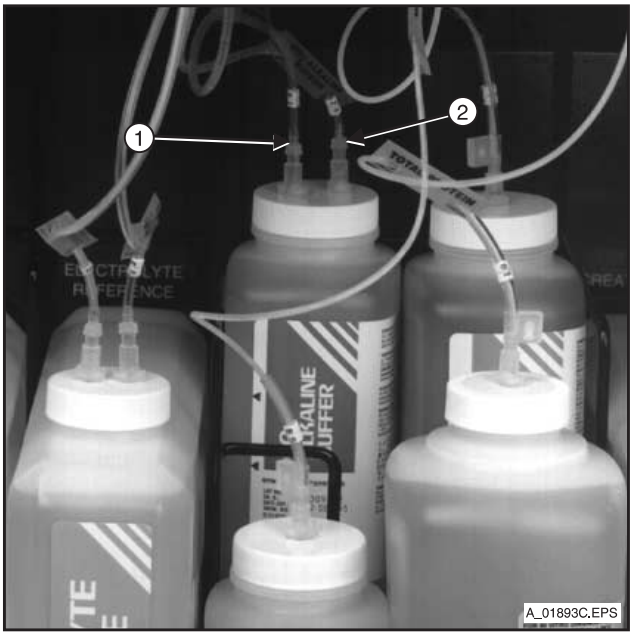
26. Reinstall the flow cell cover taking care not to pinch the tubing.

4.15.3 Carbon Dioxide Reference Electrode Replacement

1. Remove reagent line labeled #81 from the alkaline buffer reagent bottle (Figure 4-123).

NOTE

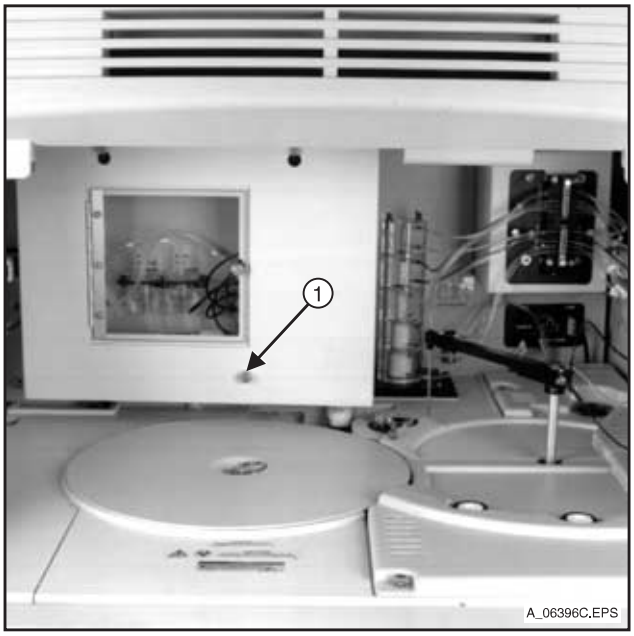
Do not remove line #82 from the alkaline buffer reagent bottle (Figure 4-123). Removing it could cause a reagent spill when the system is primed.



1 - Line #81 (alkaline buffer reagent line)
2 - Line #82 (reagent return line)

Figure 4-123. Remove Reagent Line from Alkaline Buffer

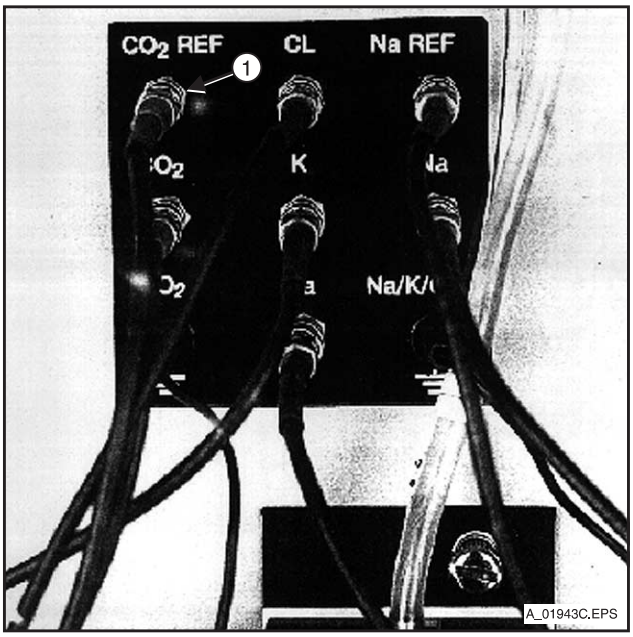
2. Prime the alkaline buffer reagent 10 times to evacuate the lines. Program the system as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** Alkaline Buffer.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining.
3. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER SCREEN, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.
4. Remove the flow cell cover by first loosening the captive retaining screw (Figure 4-124). Grasp the cover and carefully lift up and over the two guide screws. Set cover aside.



1 - Captive Screw

Figure 4-124. Flow Cell Cover

5. Disconnect the CO_2 reference electrode cable (Figure 4-125).



1 - CO_2 Reference Electrode Cable

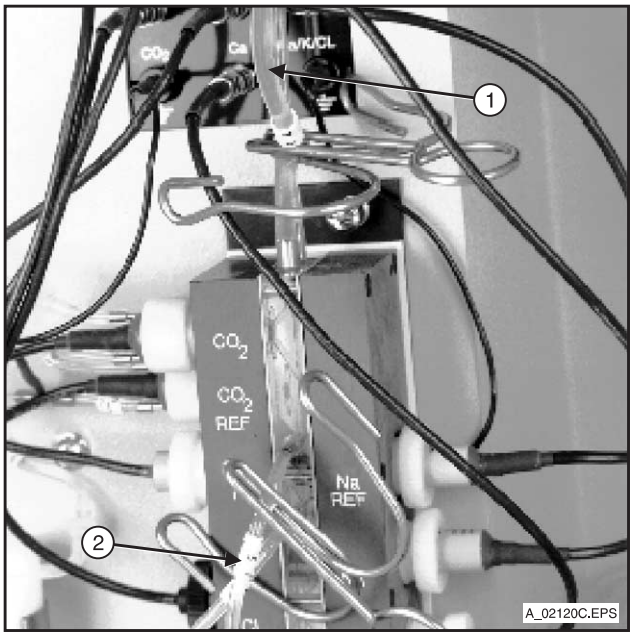
Figure 4-125. Disconnect CO_2 Reference Electrode Cable.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from the flow cell solenoid valve.

6.

(a) Using a clamp, securely clamp the top front electrolyte drain tubing (line #71) approximately one inch (25 mm) from the top of the flow cell (Figure 4-126). This will prevent the backflow of reagent into the flow cell.



1 - Line #71, Electrolyte Drain Tubing
2 - Line #57, CO_2 Acid Tubing

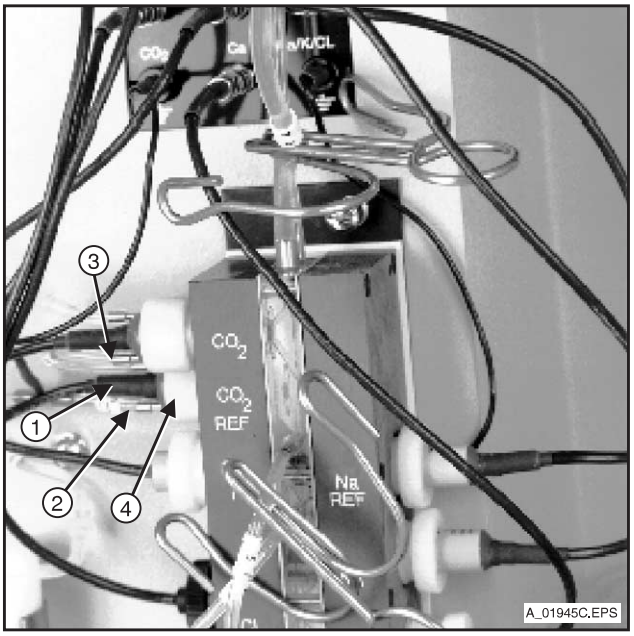
Figure 4-126. Clamps on Drain Tubings (Line #71) and (Line #57).

(b) Using another clamp, clamp off the CO_2 acid tubing (line #57) on the front of the flow cell as close to the connector as possible (Figure 4-126). This will prevent acid flow into the flow cell.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from the flow cell solenoid valve.

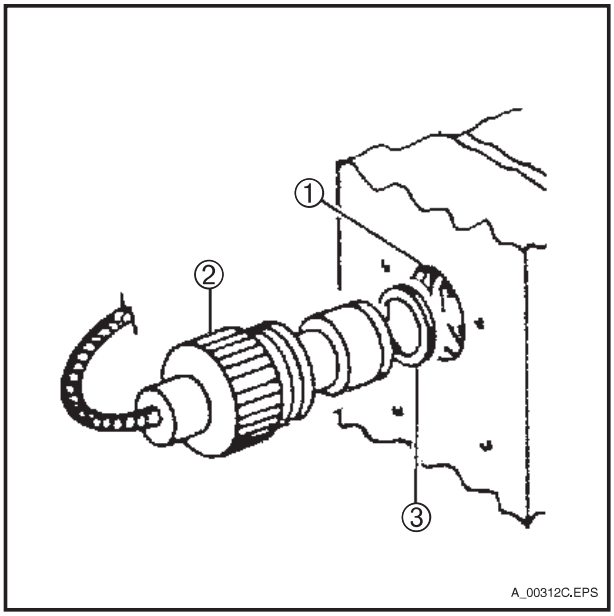
7. Locate the CO_2 reference electrode. Remove reagent lines labeled #75 and #78 from the electrode (Figure 4-127). Remove electrode by turning the retainer nut counterclockwise.



1 - CO_2 Reference Electrode
2 - Line #75
3 - Line #78
4 - Retainer Nut

Figure 4-127. Electrode Placement on the Flow Cell

8. Remove quad-ring and quad-ring retainer (Figure 4-128). Inspect electrode port if the quad-ring is not on the electrode tip. Remove the retainer nut from the old electrode.



1 - Electrode Port
2 - Retainer Nut
3 - Quad-Ring

Figure 4-128. Remove Quad-Ring

9. Using a lint-free tissue, dry the electrode assembly and electrode port to remove all traces of moisture.

NOTE

Electrode and electrode port must be completely dry before reinstalling electrode.

10. Install quad-ring and quad-ring retainer onto the new CO_2 reference electrode. When installed, the quad-ring must be on the very end of the CO_2 reference electrode. This ensures a proper fluid seal when the electrode is installed in the flow cell.

NOTE

The CO_2 reference electrode does not have a membrane.

11. Insert the new CO_2 reference electrode into the electrode port. Be careful to align key on electrode with keyway in the electrode port.
12. Turn the electrode retainer nut clockwise until finger-tight.
13. To test for proper seating of electrode, gently pull on electrode body (Figure 4-129). The electrode assembly should not move. If the elec-

trode moves, remove it and reinstall. Check for an extra or missing quad-ring if installation is difficult. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

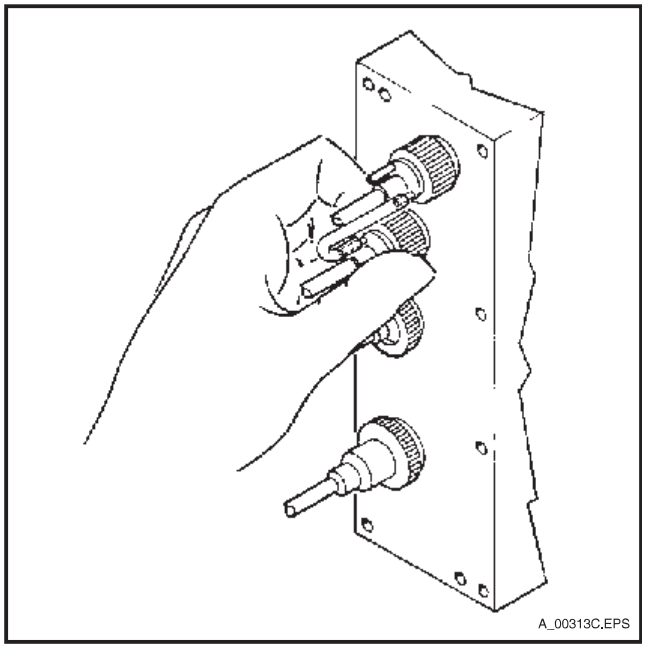


Figure 4-129. Testing for Proper Seating of CO_2 Reference Electrode.

14. Reconnect tubing lines labeled #75 and #78 to the electrode (refer to Figure 4-127).
15. Reconnect electrode cable to the appropriate connector (refer to Figure 4-125).
16. Reconnect reagent line #81 to alkaline buffer reagent bottle (refer to Figure 4-123).
17. Remove clamps from top front of flow cell drain and CO_2 acid tubings (refer to Figure 4-126).
18. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
19. Prime CO_2 Alkaline peri-pump 10 times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Alkaline Buffer.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining. While system is priming observe flow cell for leaks. Stop priming if any leaks are noticed and correct problem.
20. Reinstall the flow cell cover taking care not to pinch the tubing.

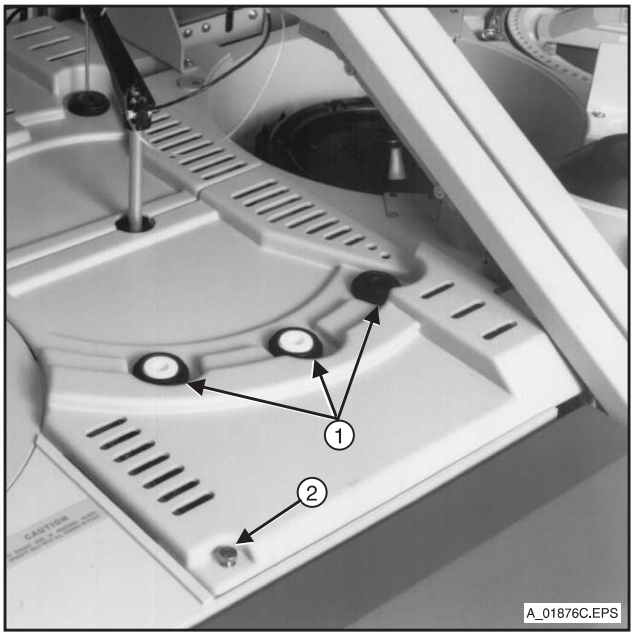
4.15.4 Chloride Electrode Replacement

For instructions on chloride electrode removal and replacement, refer to the appropriate Operating Instructions.

4.15.5 Glucose Electrode Removal and Replacement

Plan to allow 30 minutes for the electrode to achieve temperature stability following this procedure.

1. Remove the front shield over the BUN, glucose and total protein (or calcium) chemistry reaction cups as follows:
   (a) Unscrew and remove the three retaining nuts and one thumb screw (Figure 4-130).
   (b) Gently lift shield off.



1 - Retaining Nuts
2 - Retaining Screw

Figure 4-130. Removing Front Chemistry Cup Shield.

2. Prepare chemistry reaction cup for maintenance as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

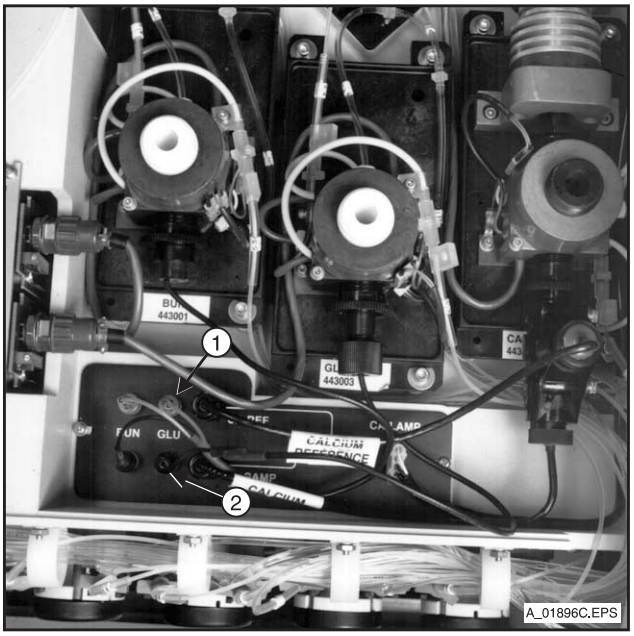
   (b) Cursor and **SELECT** 6. Maintenance Procedures or type **6** and **ENTER**.

   (c) Cursor and **SELECT** 6. CX3 Chemistry Maintenance or type **6** and **ENTER**.

   (d) Cursor and **SELECT** GLU3.

   (e) Press **F1 CONTINUE**. This will drain the cup of reagent so that maintenance may be performed.

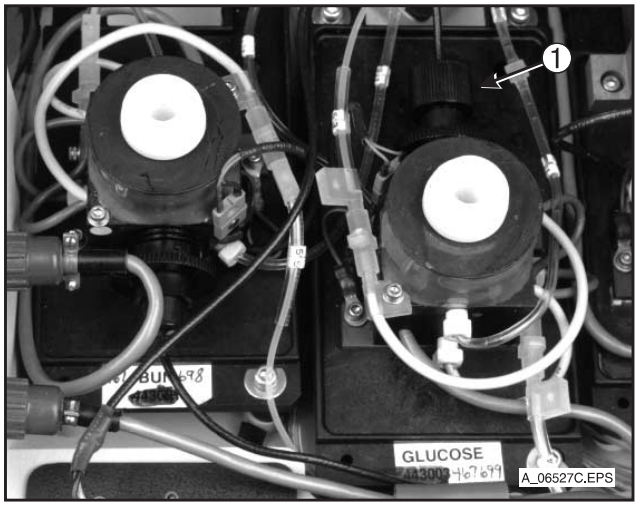
3. Disconnect red and black glucose pin leads from connector panel (Figure 4-131).



1 - Red
2 - Black

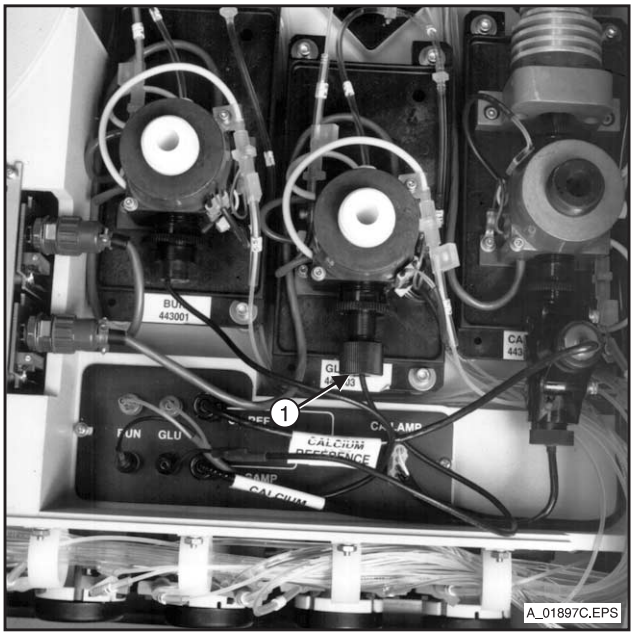
Figure 4-131. Disconnect Red and Black Pin Leads

4. Unscrew glucose electrode retainer nut and withdraw electrode-assembly from chemistry reaction cup (Figure 4-132A. Figure 4-132B).



A
1 - Retainer Nut

Figure 4-132. Glucose Electrode (CX7 DELTA)



B
1 - Retainer Nut

Figure 4-132. Glucose Electrode (CX7)

5. Using lintless tissue saturated with 70% isopropanol, clean mounting port for electrode.

6. Using dry, lintless tissue, wipe electrode mounting port.
7. Recharge electrode as follows:
   (a) Unscrew electrode cap nut and withdraw electrode from retainer. Set retainer nut aside for later reinstallation.
   (b) Remove O-ring and membrane from end of retainer. Discard membrane.
   (c) Rinse retainer and O-ring in deionized water and dry with lintless tissue.
   (d) Place O-ring on sheet of lintless paper.
   (e) Place new membrane (P/N 670597) on top of O-ring and center. Avoid contacting membrane with fingers.

NOTE

Always discard paper disk that separates new membranes.

   (f) Push electrode retainer onto O-ring. Check membrane for proper seating: no wrinkles or tears in the membrane appearance.

CAUTION

Do not seat membrane on retainer with twisting motion as retainer could slice membrane.

   (g) Place retainer nut on retainer and set aside for later use.
   (h) Wipe old gel from face of electrode and rinse electrode body thoroughly in deionized water. Wipe circular silver anode firmly with clean, moistened tissue and use edge of fingernail to remove oxidation products. The wooden end of an applicator stick may also be used, but DO NOT use a needle or any other metal object.

CAUTION

Never rinse electrode in alcohol, as damage to the electrode may result.

   (i) Wipe electrode dry.
   (j) Apply liberal amount of gel to tip of electrode, then wipe away to condition electrode glass for fresh charge of gel.
   (k) Apply fresh gel to electrode tip, to a depth of 1/16 to 1/8 inch (1.59 to 3.18 mm). Cover entire tip of electrode, being careful not to leave air bubbles.
8. Reinstall the glucose electrode as follows:

CAUTION

DO NOT over tighten electrode cap nut (Step 8a) as membrane and O-ring can be pushed off the end of the retainer.

   (a) Align key on electrode with keyway in retainer. Carefully insert electrode into retainer. Finger tighten electrode cap nut.
   (b) Align key on electrode-retainer assembly with keyway on electrode port and finger-tighten in place with retainer nut.
9. Reconnect red and black glucose plugs into connector panel (refer to Figure 4-131).
10. Press **PREV SCREEN**.
11. Prime as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** GLU3.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type **3** and press **ENTER**. The display indicates the number of primes remaining.
12. While module is priming, observe lines and chemistry reaction cup to determine there are no leaks. Stop the priming if any leaks are noticed and correct the problem.
13. Observe stirrer to verify that it is rotating properly.
14. Carefully place shield over chemistry reaction cups. Take care that wires and tubes are not pinched under edges of cover.
15. Replace and secure the three retaining nuts and one thumb screw on the shield.
16. Close compartment door.

This completes the recharging of the glucose electrode and cleaning of the chemistry reaction cup and stirrer. Allow 30 minutes for temperature stability before calibration and operation of this module.

4.15.6 Potassium Electrode Body or Electrode Tip Replacement

For instructions on potassium electrode body or electrode tip replacement, refer to the appropriate Operating Instructions.

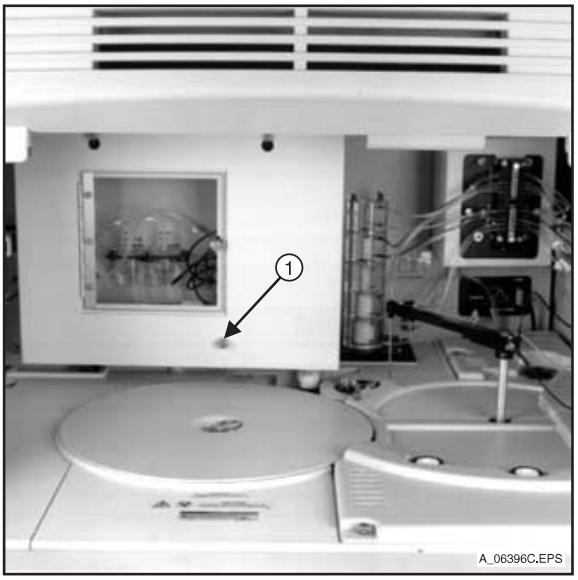
4.15.7 Calcium Electrode Body or Electrode Tip Replacement

For instructions on calcium electrode body or electrode tip replacement, refer to the appropriate Operating Instructions.

4.15.8 Sodium Electrode Replacement

The sodium electrode must soak for a minimum of one (1) hour before installation. For instructions on preparing sodium measuring and reference electrode before installation, refer to paragraph 4.26.

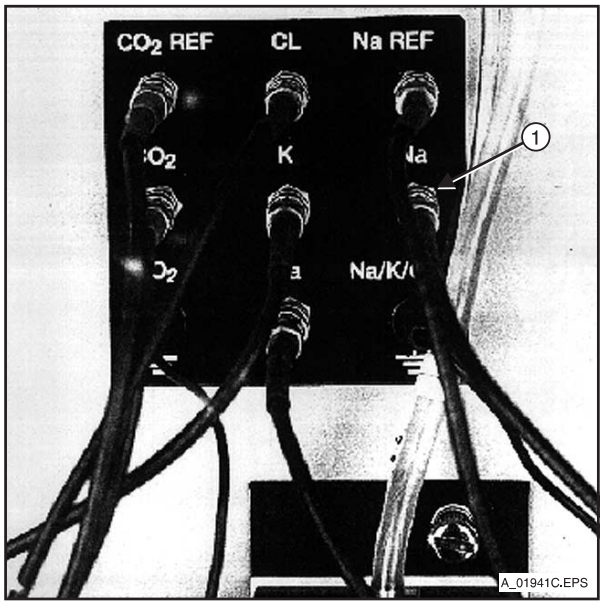
1. Assure that the system is in STANDBY, then
   (a) From the MASTER SCREEN, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.
2. Swing the crane arm to the right, away from the flow cell cover.
3. Remove the flow cell cover by removing the captive screw located at the bottom of the flow cell cover (Figure 4-133). Grasp the cover and carefully lift up and over the two remaining guide screws. Set cover aside.



1 - Captive Screw

Figure 4-133. Flow Cell Cover

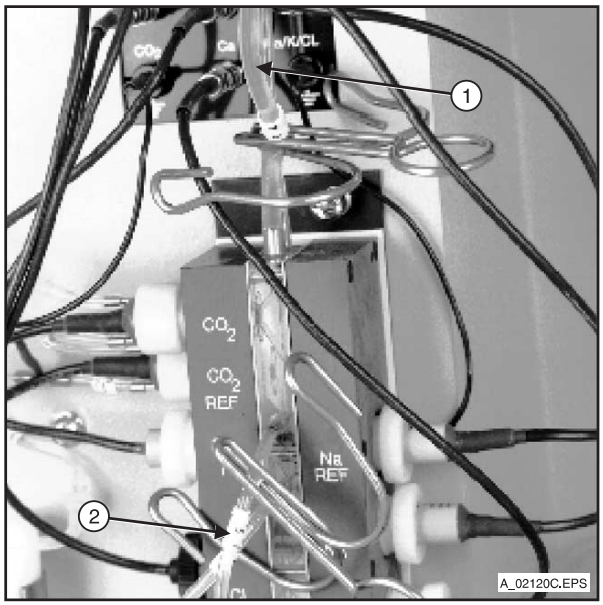
4. Disconnect sodium electrode cable (Figure 4-134).



1 - Sodium Electrode Cable

Figure 4-134. Disconnect Sodium Electrode Cable

5.
   (a) Using a clamp, securely clamp the front piece (line #71) of electrolyte drain tubing approximately one inch (25 mm) from the top of the flow cell (Figure 4-135). This will prevent the backflow of reagent into the flow cell.



1 - Line #71, Electrolyte Drain Tubing
2 - Line #57, CO_2 Acid Tubing

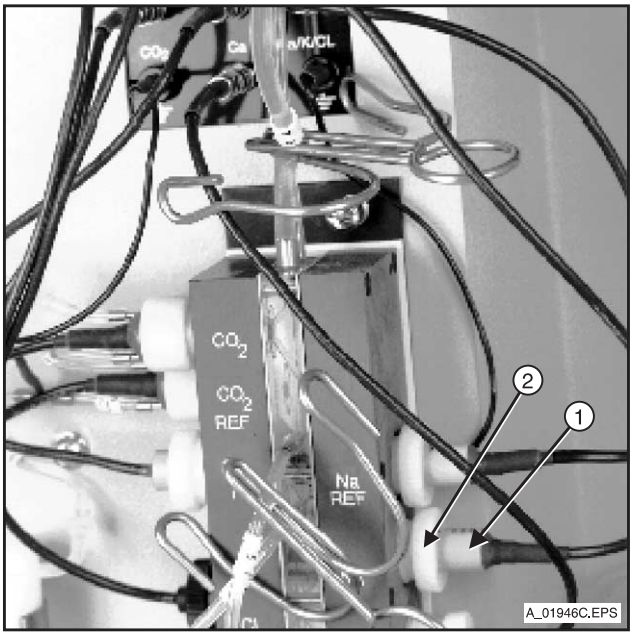
Figure 4-135. Clamps on Drain Tubings (Line #71) and (Line #57)

(b) Using another clamp, clamp off the CO2 acid tubing (line #57) on the front of the flow cell as close to the connector as possible (Figure 4-135). This will prevent acid flow into the flow cell.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from flow cell solenoid valve.

6. Locate sodium electrode (Figure 4-136). Remove electrode by turning the electrode retainer nut counterclockwise. Inspect the electrode port if the quad-ring seal is not on the end of the electrode. Remove retainer nut and save for re-use on new electrode. Discard old electrode.



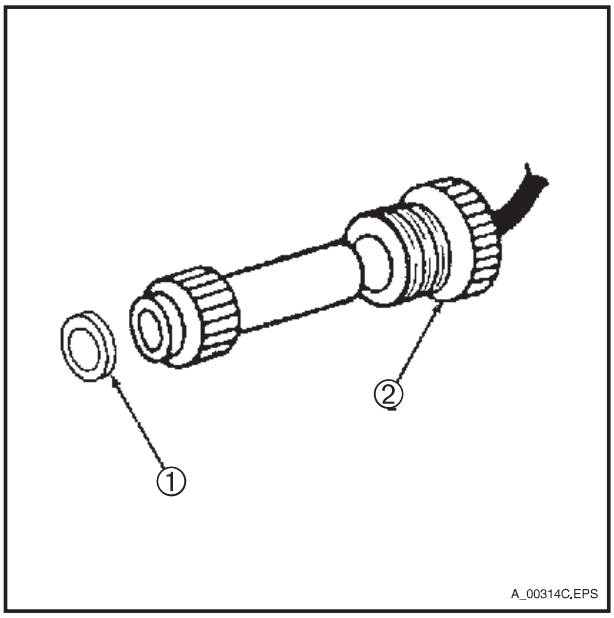
1 - Sodium Electrode
2 - Retainer Nut

Figure 4-136. Remove Sodium Electrode

7. Place the retainer nut on the PRESOAKED sodium electrode.

8. Examine the electrode tip. If an air bubble is seen inside the tip, hold the electrode cable near the end and spin the electrode for a few seconds. The bubble should be pushed back inside the electrode and remain there away from the tip.

9. Install a new quad-ring on the electrode (Figure 4-137). Thoroughly clean the electrode port with distilled water and dry with lintless tissue.



1 - Quad-ring
2 - Retaining Nut

Figure 4-137. Replace Quad-Ring

CAUTION

Do not pack tissue into the port or damage may occur to the flow cell internal wire.

10. Insert new electrode into electrode port and turn retainer nut clockwise until finger-tight.

11. To test for proper seating of electrode, gently pull on electrode body (Figure 4-138). The electrode assembly should not move. If the electrode moves, remove it and reinstall. If installation is difficult, check for an extra or missing quad-ring. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

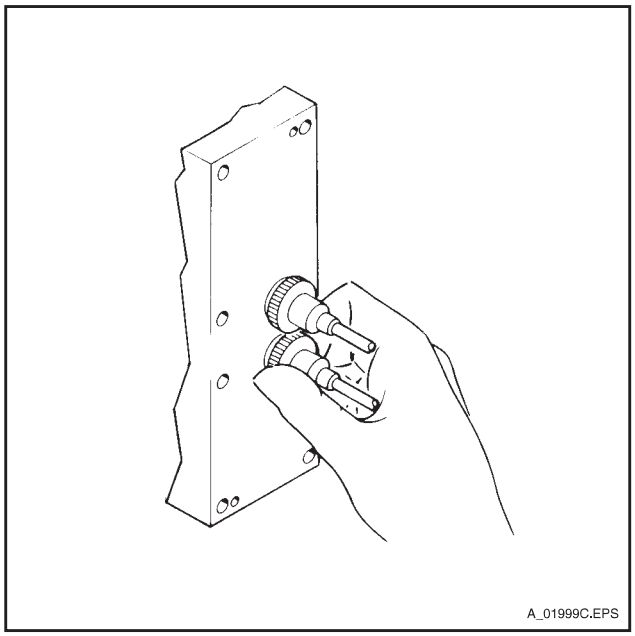


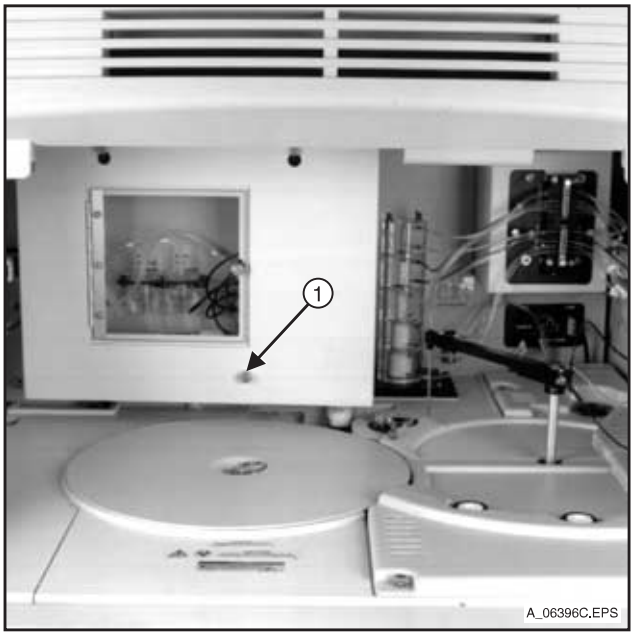
Figure 4-138. Testing for Proper Seating of Sodium Electrode

12. Reconnect electrode cable to the appropriate connector.
13. Remove clamps from front electrolyte drain and CO_2 acid tubings.
14. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
15. Prime the electrolyte buffer and CO_2 acid reagents five times by running "Ratio Pump" prime. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Ratio Pump.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **5** and press **ENTER**. The display indicates the number of primes remaining.

    Check for leaks. If any are noted, stop priming and repair. Remember to pinch off the front drain tubing if the sodium electrode is removed.
16. Reinstall the flow cell cover taking care not to pinch tubing.

4.15.9 Sodium Reference Electrode Replacement

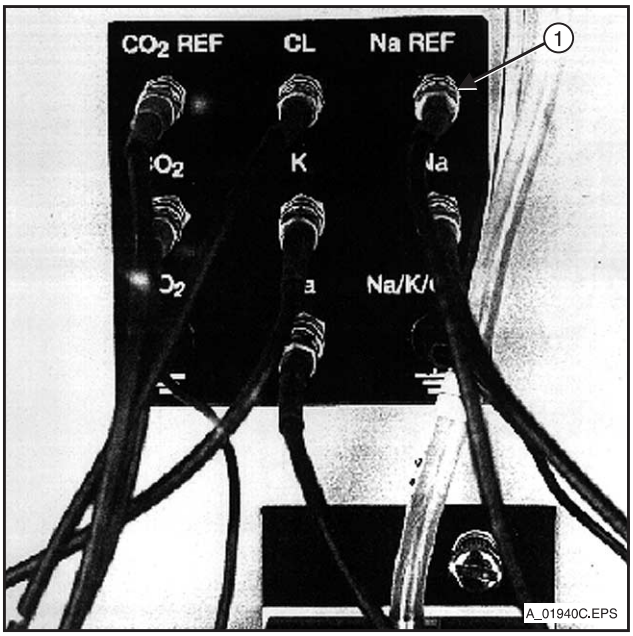
1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
    (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.
2. Swing the crane arm to the right, away from the flow cell cover.
3. Remove the flow cell cover by removing the retaining screw located at the bottom of the flow cell cover (Figure 4-139). Grasp the cover and carefully lift up and over the two remaining guide screws. Set cover aside



1 - Captive Screw

Figure 4-139. Flow Cell Cover

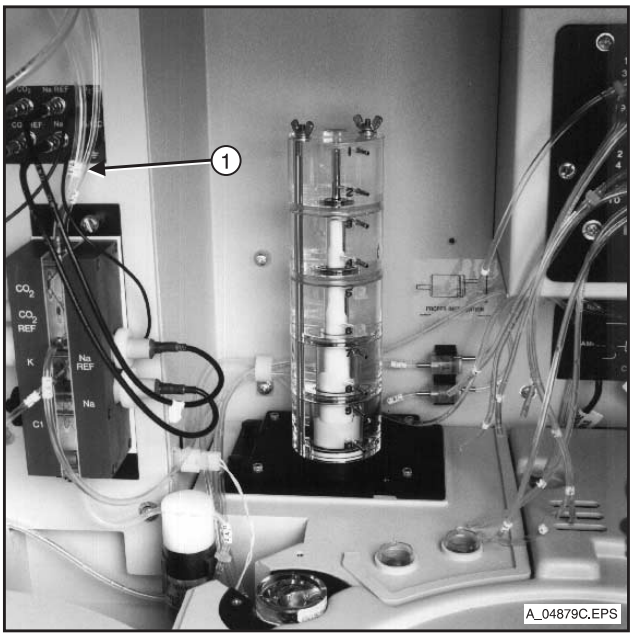
4. Disconnect sodium reference electrode cable (Figure 4-140).



1 - Sodium Reference Electrode

Figure 4-140. Disconnect Sodium Reference Electrode Cable

5. Using a clamp (or hemostat), securely clamp the top rear electrolyte drain tubing (line #79) approximately one inch (25 mm) from the top of the flow cell (Figure 4-141). This will prevent the backflow of reagent into the flow cell.



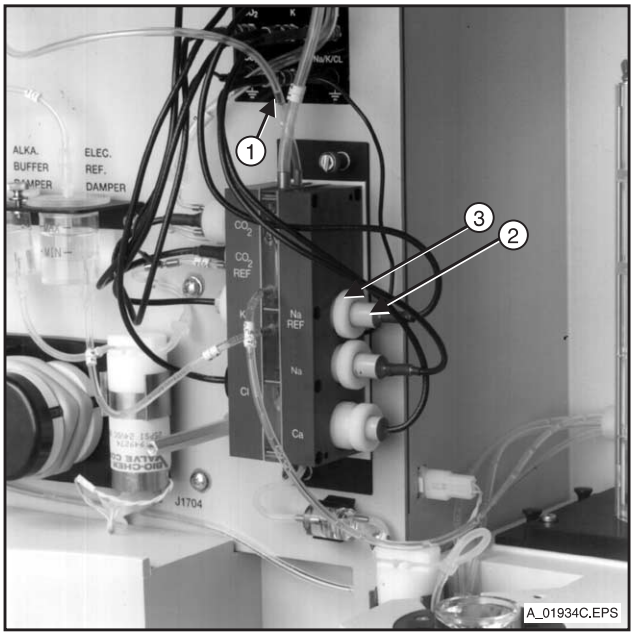
1 - Line #79

Figure 4-141. Hemostat on Drain Tubing (Line #79)

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from flow cell solenoid valve.

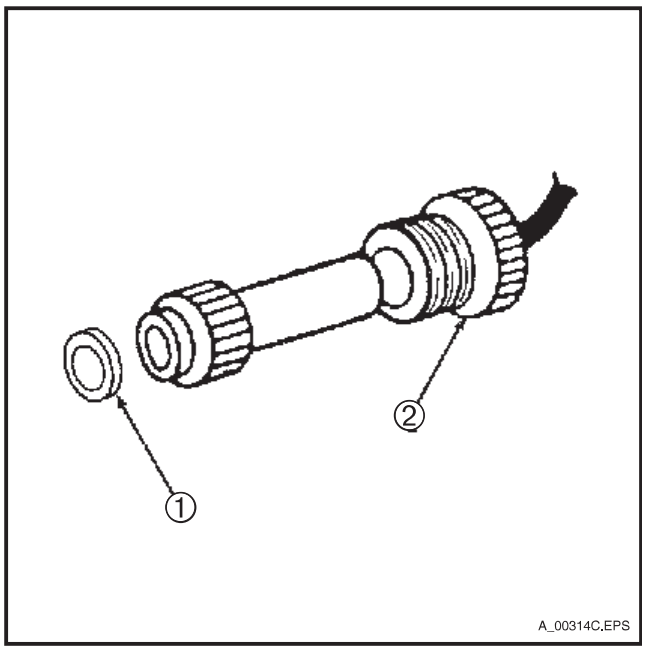
6. Locate the sodium reference electrode (Figure 4-142). Remove electrode by turning the electrode retainer nut counterclockwise. Inspect the electrode port if the quad-ring seal is not on the end of the electrode.



1 - Line #79
2 - Sodium Reference Electrode
3 - Retainer Nut

Figure 4-142. Remove Sodium Reference Electrode

7. Remove the retainer nut from the old electrode (Figure 4-143). Save retainer nut for re-use. Discard the old electrode.



1 - Quad-Ring
2 - Retaining Nut

Figure 4-143. Remove Retainer Nut from Electrode

8. Place the retainer on the PRESOAKED sodium reference electrode.
9. Examine the electrode tip. If an air bubble is seen inside the tip, hold the electrode cable near the end and spin the electrode for a few seconds. The bubble should be pushed back inside the electrode and remain there away from the tip.
10. Install a new quad-ring on electrode (refer to Figure 4-143). Thoroughly clean the electrode port with distilled water and dry with a lint-free tissue.
11. Insert electrode into electrode port and turn retainer nut clockwise until finger-tight.
12. To test for proper seating of electrode, gently pull on electrode body (Figure 4-144). The electrode assembly should not move. If the electrode moves, remove it and reinstall. If installation is difficult, check for an extra or missing quad-ring. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

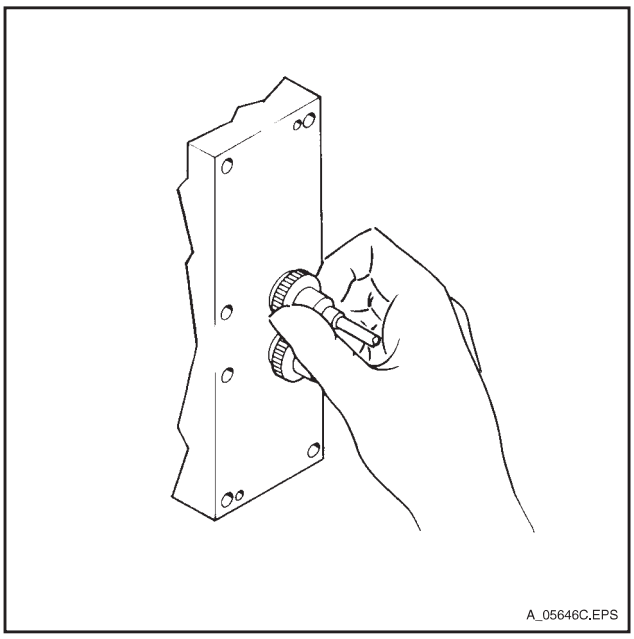


Figure 4-144. Testing for Proper Seating of Sodium Reference Electrode

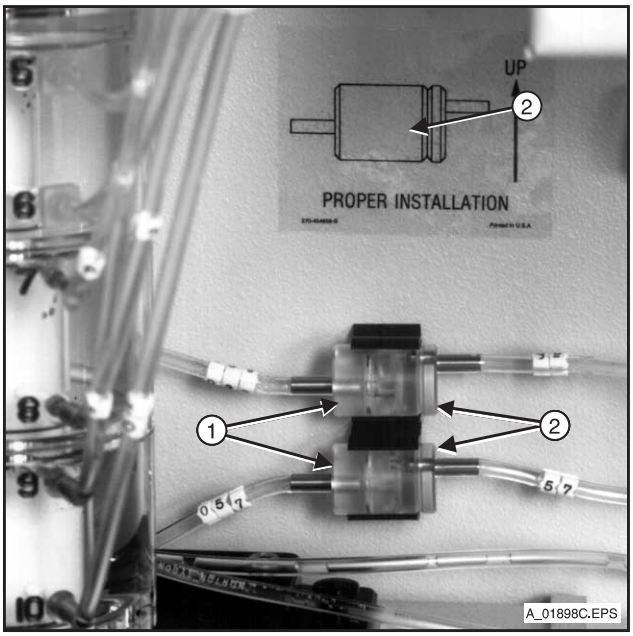
13. Reconnect electrode cable to the appropriate connector.
14. Remove hemostat from rear electrolyte drain tubing.
15. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
16. Prime the electrolyte reference reagent five times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Electrolyte Reference Flow Cell.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **5** and press **ENTER**. The display indicates the number of primes remaining.

    Check for leaks. If any are noted, stop priming and repair. Remember to pinch off the rear drain tubing if the sodium reference electrode is removed.

17. Reinstall flow cell cover taking care not to pinch tubing.

4.16 FLOW MIXER REPLACEMENT

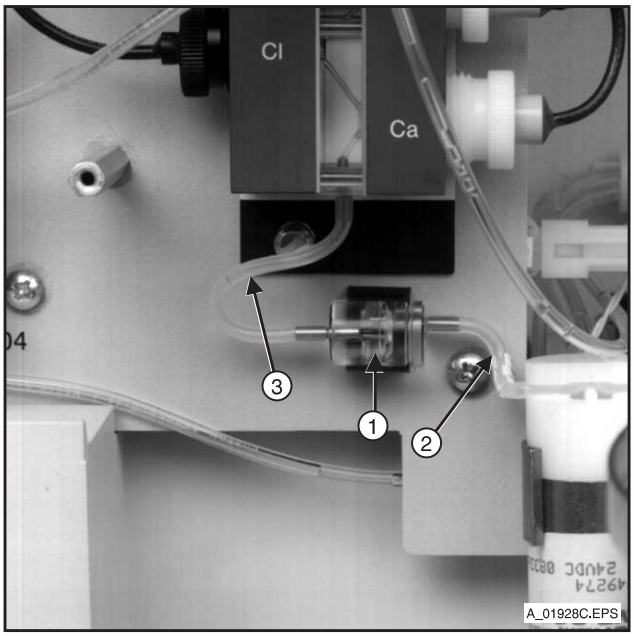
1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.
2. Slide flow mixer through mounting clamp (Figure 4-145).



1 - Flow Mixers
2 - Input End Groove

Figure 4-145. Flow Mixers

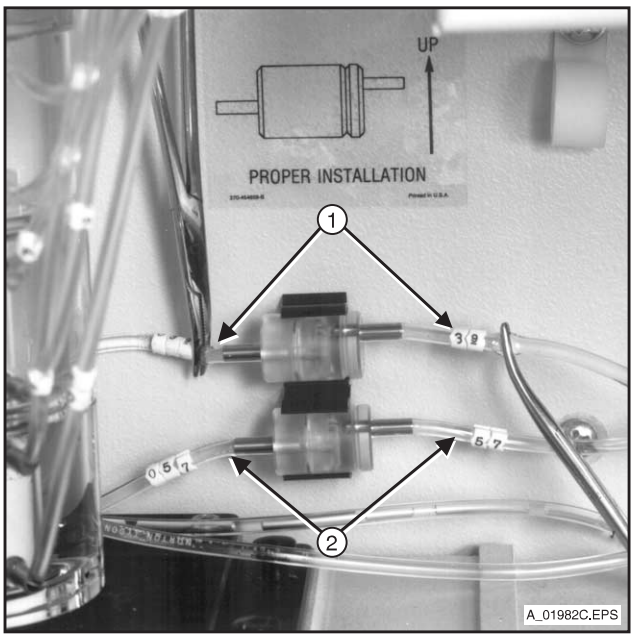
3. Using two hemostats, securely clamp the reagent input and output line for either the electrolyte buffer flow mixer (lines #039 and #39) or the CO_2 acid reagent flow mixer (lines #057 and #57) or the flow cell flow mixer on CX7 DELTA systems only, (line #72 with line between the flow mixer and flow cell). Place hemostats approximately one inch (25 mm) from the end of both sides of flow mixer to be replaced (Figures 4-146A and 4-146B).



A

1 - Flow Cell Mixer
2 - Line #72
3 - Line Between Flow Mixer and Flow Cell

Figure 4-146. Flow Cell Flow Mixer (CX7 DELTA system only)



B

1 - Lines #039 and #39
2 - Lines #057 and #57

Figure 4-146. Clamp Input and Output Lines of Flow Mixer

4. Remove tubing from flow mixer by firmly grasping flow mixer with one hand and pulling off tubing using a twisting motion with the other hand. Discard old flow mixer.
5. Install new flow mixer by first connecting reagent input and output lines.

NOTE

Input lines (#39 and #57 and #72) attach to the flow mixer connector which is off center. The input end is marked by a groove around the flow mixer. Output lines (#039 and #057 and the line between the flow mixer and flow cell) attach to the connector which is centered.

6. Remove hemostats.
7. Snap the flow mixer into place in its mounting clamp. Be sure to orient the mixer so that the right or input, tubing is as high as possible (refer to Figure 4-145 and Figure 4-146A).
8. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
9. Prime the ratio pump five times to remove any bubbles which may be present in either the electrolyte buffer or the CO_2 acid flow mixers and lines. Program the system as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** Ratio Pump.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type **5** and press **ENTER**. The display indicates the number of primes remaining.
10. Check for leaks while priming. If any are seen, stop priming and repair.

4.17 PERI-PUMP ASSEMBLY REPLACEMENT

NOTE

If more than one pump needs to be replaced, perform each replacement one at a time to avoid interchanging input and output lines.

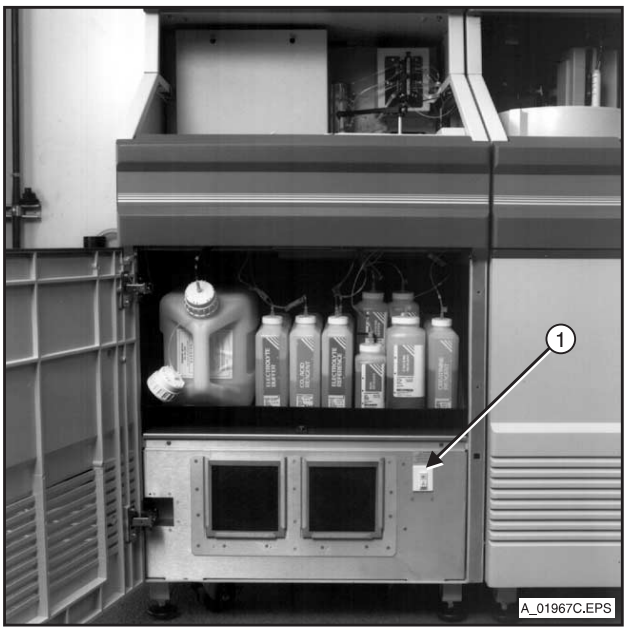
To avoid spilling reagent or waste material, first remove the input line from the left side of the peri-pump tubing. Manually turn peri-pump counterclockwise five revolutions to evacuate the lines before attempting to replace peri-pump assembly.

Note that reagent flow through the pumps is in same direction as counterclockwise movement of pump rotor.

1. From the MASTER Screen, press **SYSTEM IDLE**. The screen will prompt: “Continue with the shut down procedure (Y/N)?”
2. Press **Y**. The screen will display:

   “SYSTEM IDLE” “CX3: STANDBY”
   “CONSOLE: “ “CX4: STANDBY”

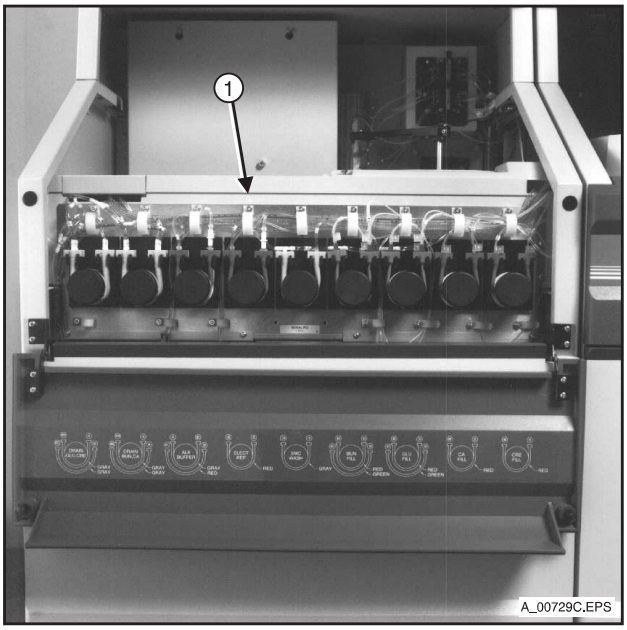
3. Press **F4 RESUME**. The screen will prompt: “This will reboot the system. Continue with the Resume procedure (Y/N)?”
4. Press **Y**, the **ENTER**. The message window will prompt: “Press <**PREV SCREEN**> to continue” (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red “**POWER DOWN SCREEN**” will prompt you to: “Turn Off CX Instrument and/or Console Power Now.”
   (a) Turn the PC console power OFF using the switch on the front of the console unit.
7. Press CX3 power switch located behind the left front panel of the lower compartment to OFF position (Figure 4-147). Close compartment door.



1 - Power Switch

Figure 4-147. CX3 Power Switch

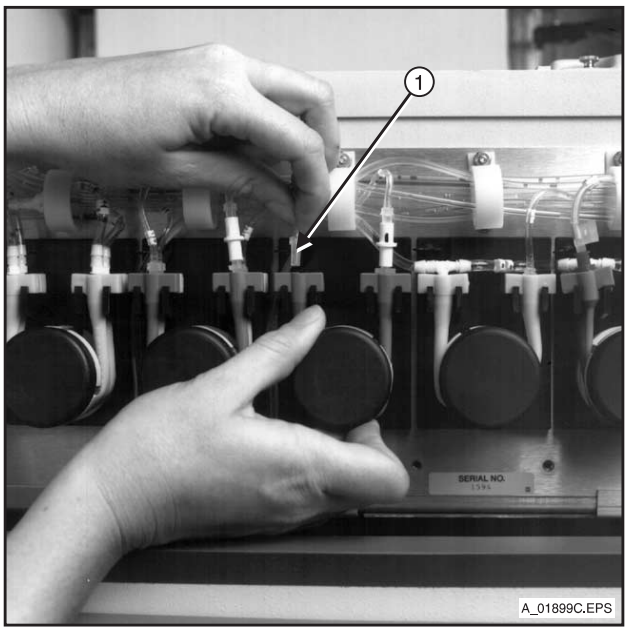
8. Open peri-pump compartment cover to expose peri-pump assemblies (Figure 4-148). On CX7 DELTA systems, open reagent compartment door to expose peri-pump assemblies.



1 - Peri-pump Assemblies

Figure 4-148. Peri-Pump Compartment

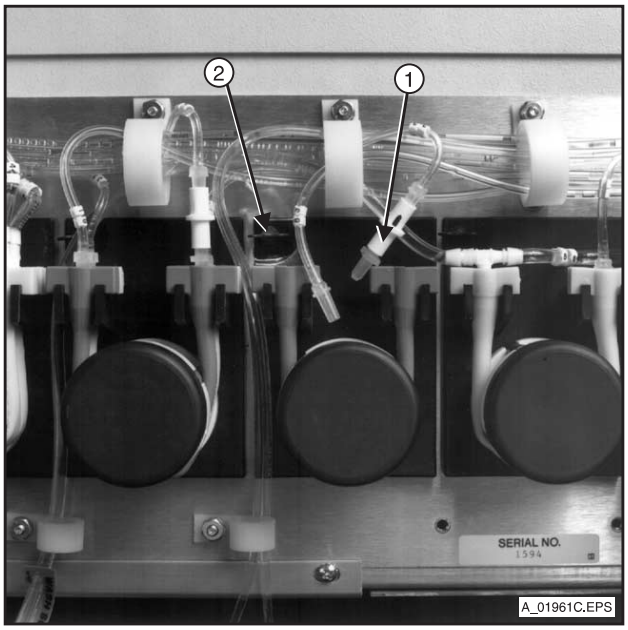
9. For peri-pump assemblies, remove input line from peri-pump tubing (Figure 4-149).



1 - Input Line

Figure 4-149. Remove Input Line from Peri-Pump

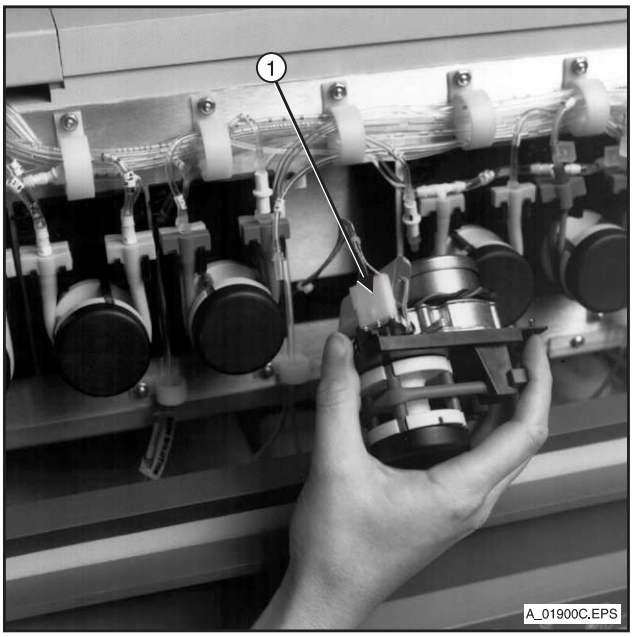
10. Manually rotate the peri-pump three to five revolutions counterclockwise to empty the lines (Figure 4-149).
11. Remove output line from pump tubings.
12. While supporting weight of pump assembly, turn wing nut at top left of pump assembly mounting plate (Figure 4-150) counterclockwise until completely loosened (about 1/4 turn).



1 - Output Line
2 - Wing Nut

Figure 4-150. Loosen Wing Nut

13. Pull pump assembly away from module.
14. Unplug connector at back of pump assembly mounting plate. Discard old pump assembly (Figure 4-151).



1 - Connector

Figure 4-151. Unplug Connector

15. Plug in connector from new pump assembly at back of mounting plate. Connector is not keyed and can be connected either way.
16. Slide pump assembly into place, bottom half first. Push in wing nut and turn 1/4 turn clockwise to lock.
17. Ensure that the new pump is installed with new tubing. For instructions refer to Section Nine in Operating Instructions.
18. Reattach input line to peri-pump tubing (left side).
19. Reattach output line to peri-pump tubing (right side).
20. Open left-hand cabinet door. Press CX3 power switch to ON position.
21. Turn the PC console power ON using the switch on the front of the console unit.
22. Inspect the system for leaks during initialization.
23. Prime peri-pump 15 times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** the appropriate reagent(s).
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **15** and press **ENTER**. The display indicates the number of primes remaining.
24. Close peri-pump compartment cover.

4.18 PINCH VALVE ASSEMBLY REPLACEMENT

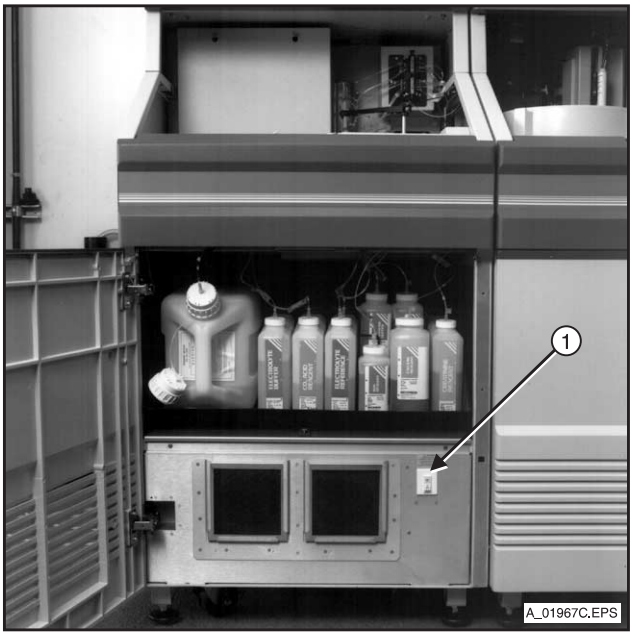
4.18.1 Pinch Valve "C" Removal and Replacement

1. Press **SYS IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"
2. Press **Y**, then **ENTER**. The screen will display:

   "SYSTEM IDLE" "CX3: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?"
4. Press **Y**, then **ENTER**. The message window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."
   (a) Turn the PC console power OFF using the switch on the front of the console unit.

7. PRESS CX3 POWER SWITCH TO OFF POSITION. The switch is located behind the left front panel of the lower compartment (Figure 4-152) Close compartment door.



1 - Power Switch

Figure 4-152. CX3 Power Switch

8. Before proceeding...

WARNING

TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

9. Open hinged peri-pump compartment cover (Figure 4-153). On CX7 DELTA systems, open reagent compartment door to expose peri-pump assemblies.

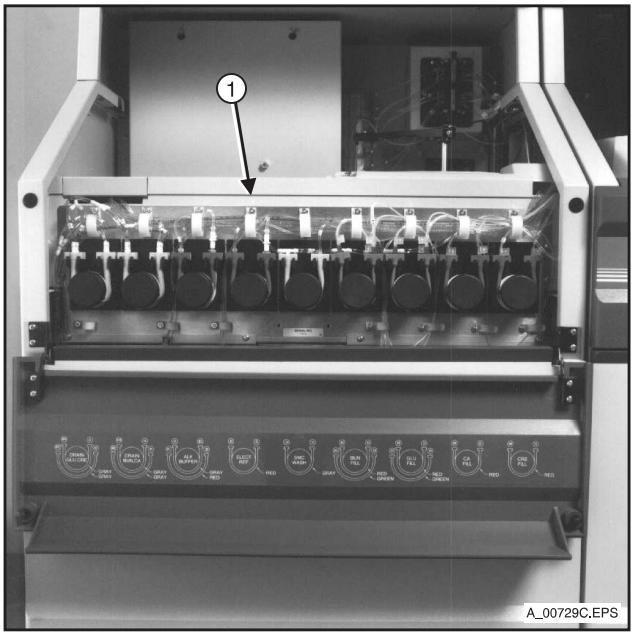
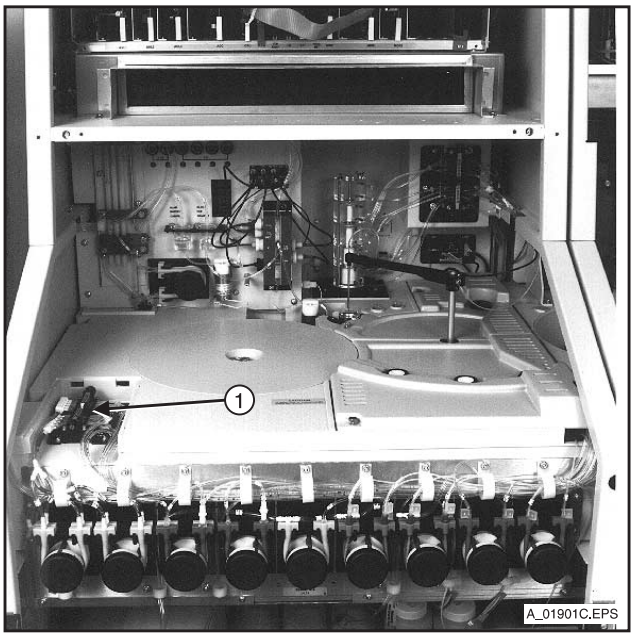


Figure 4-153. Peri-Pump Compartment

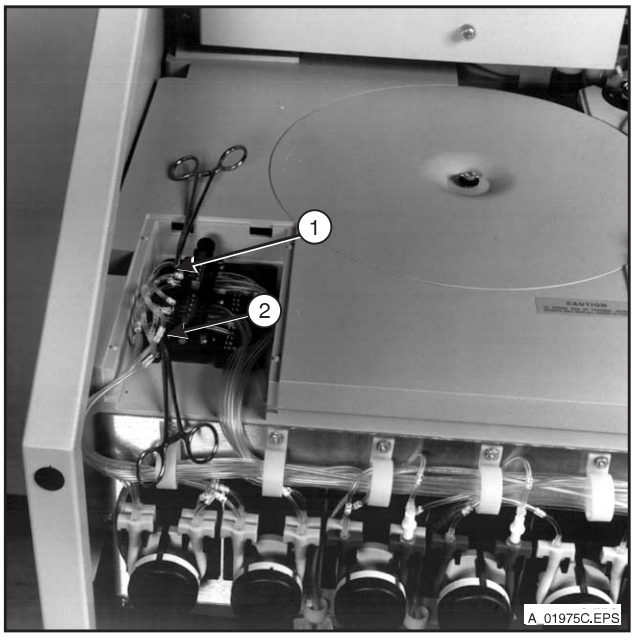
10. Slide open cover on left front corner of the analyzer to reveal pinch valve “C” (Figure 4-154).



1 - Pinch Valve “C”

Figure 4-154. Multi-Pinch Valve “C”

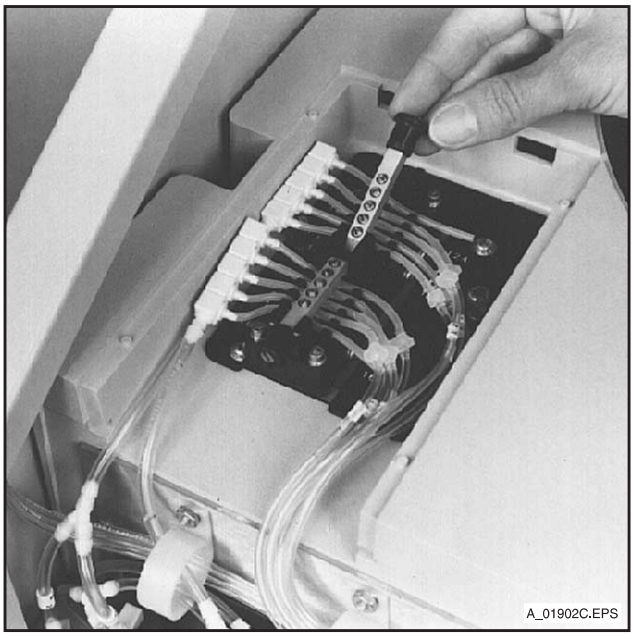
11. Using a hemostat, securely clamp lines #124 and #168 to prevent any reagent leakage (Figure 4-155).



1 - Line #124
2 - Line #168

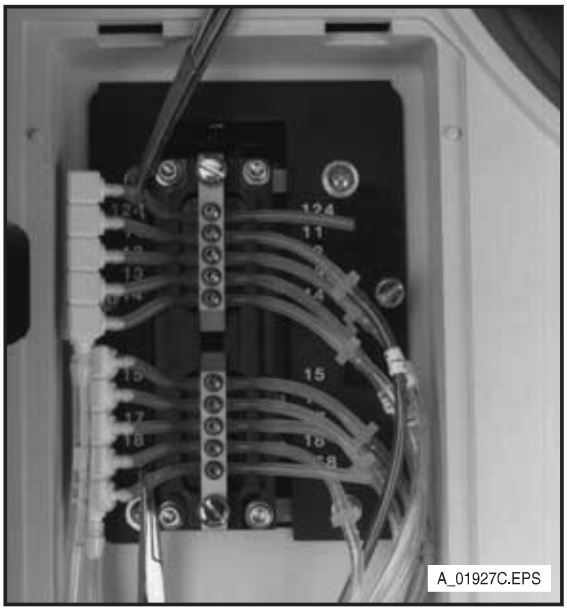
Figure 4-155. Securely Clamp Lines #124 and #168

12. Release pressure bars by pulling out and lifting up on the black release knob, or loosen the screws that hold down the pressure bar (Figures 4-156A and 4-156B) and gently lift bar upward. Remove all the tubing (lines #11 through #18, #124, and #168) from the pinch valve assembly.



A

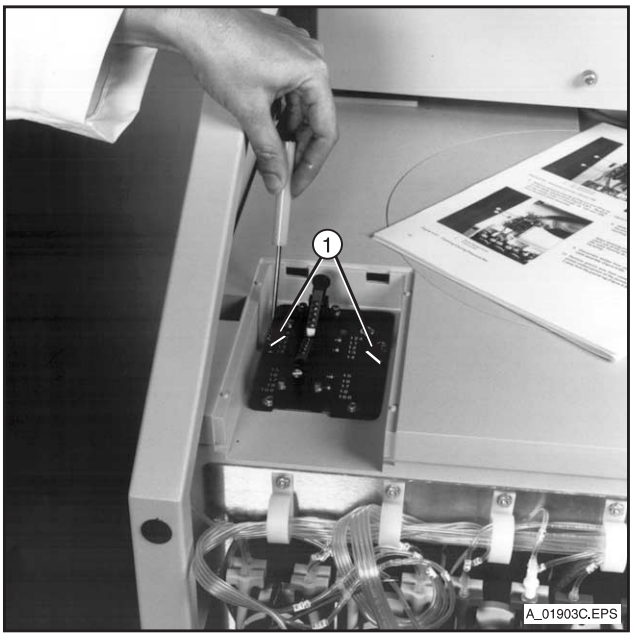
Figure 4-156. Release Pressure Bars



B

Figure 4-156. Pinch Valve Assembly

13. Unscrew two captive mounting screws (Figure 4-157).



1 - Captive Mounting Screws

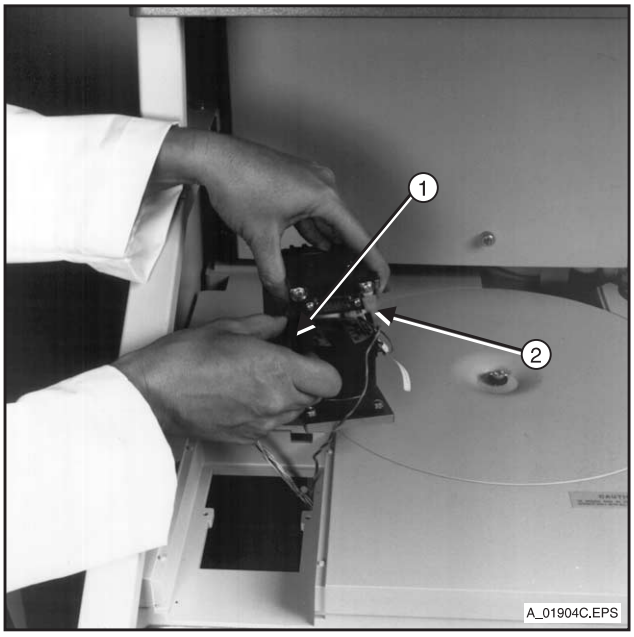
Figure 4-157. Captive Mounting Screws

14. While holding the tubing aside with one hand, grasp the pinch valve assembly and remove it from the mounting location.

CAUTION

When removing pinch valve, be careful not to catch any of the valve wiring on the sides of the valve housing as damage may occur to the wiring.

15. Disconnect socket from plug on back of pinch valve assembly (Figure 4-158).



1 - Socket
2 - Ground Wire

Figure 4-158. Disconnect Socket

16. Remove ground wire from valve by holding the plastic coated portion of the connector and pulling it away from the ground lug (Figure 4-158).
17. Connect socket to plug on back of the new pinch valve “C” assembly.
18. Attach the ground wire to ground lug.
19. While holding the tubing aside with one hand place new pinch valve assembly into mounting position.
20. Tighten the two captive mounting screws.
21. Open pressure bars. Place reagent lines (#11 through #18, #124, and #168) into their respective pinch valve slots.
22. Close pressure bars.
23. Remove hemostat from vent lines #124 and #168.
24. Reconnect system power cord to power source.

25. Press CX3 system power switch to the ON position.

    (a) Turn the PC console power ON using the switch on the front of the console unit.

26. Prime the wash solution, BUN, glucose, total protein (or calcium), and creatinine reagents three times. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** GLU3, CRE3, TP3 (or CA3), BUN3, and WASH SOLUTION.

    (d) Operator is prompted to enter the number of prime cycles. Type **3** and press **ENTER**. The display indicates the number of primes remaining.

27. Inspect the system for leaks during priming. Stop the priming if any leaks are noticed and correct the problem.

28. Replace sliding cover over pinch valve "C" assembly. Close peri-pump compartment cover. Be careful not to pinch the tubing.

NOTICE

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.18.2 Pinch Valve 'E'' Removal and Replacement

1. Disconnect lines labeled #84, #4, #6, and #2 from reagent bottles and wash bottle.

2. Prime the electrolyte buffer, CO_2 acid reagent, electrolyte reference reagent, and wash solution 20 times. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** Ratio Pump.

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

3. From the MASTER Screen, press **SYSTEM IDLE**. The screen prompts: "Continue with the shut down procedure (Y/N)?"

4. Press **Y**. The screen will display:

    "SYSTEM IDLE" "CX3: STANDBY"
    "CONSOLE: " "CX4: STANDBY"

5. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure?"

6. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).

7. Press **PREV SCREEN**. A window will pop up giving four boot options.

8. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."

    (a) Turn the PC console power OFF using the switch on the front of the console unit.

9. Press CX3 power switch located behind the left front panel of the lower compartment to OFF (Figure 4-159). Close compartment door.

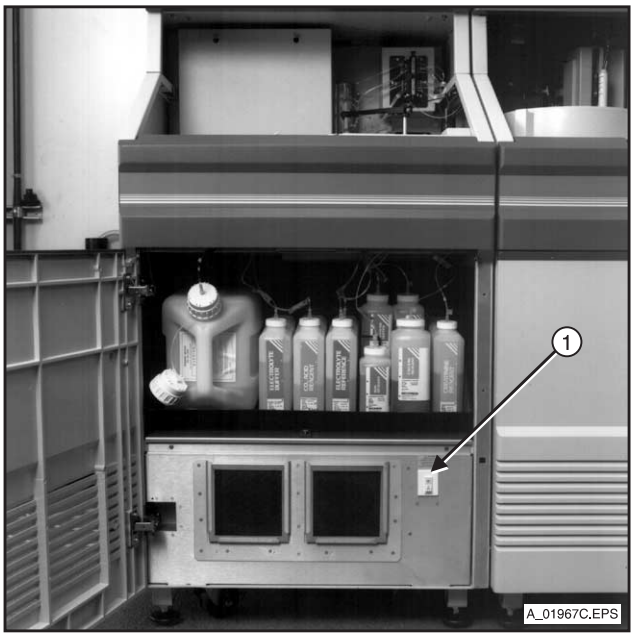
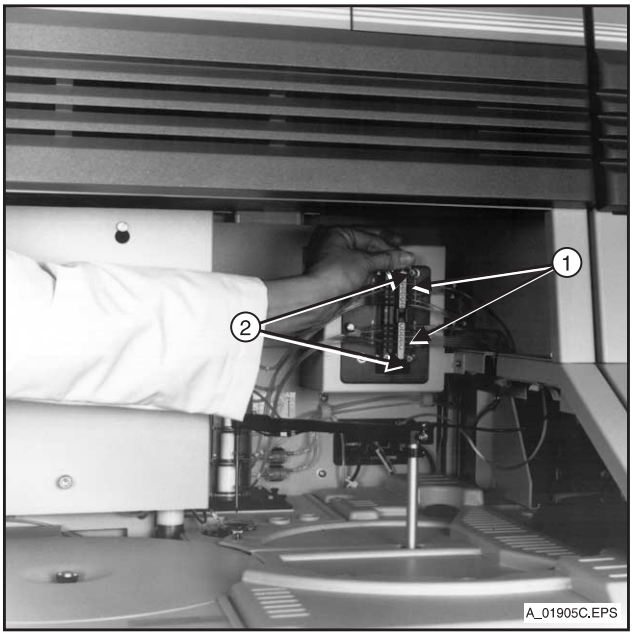


Figure 4-159. CX3 Power Switch

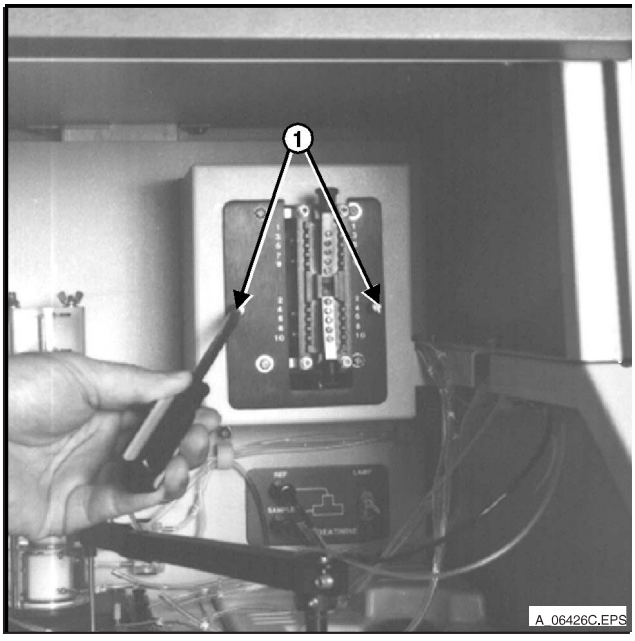
10. Release pressure bars by pulling out and lifting up on black release knob, or loosen the screws that hold down the pressure bar (Figure 4-160) and gently lift bar upward.



1 - Pressure Bar
2 - Release Knob

Figure 4-160. Release Pressure Bars

11. Remove all the tubing from the pinch valve assembly.
12. Unscrew two captive mounting screws (Figure 4-161).



1 - Captive Screws

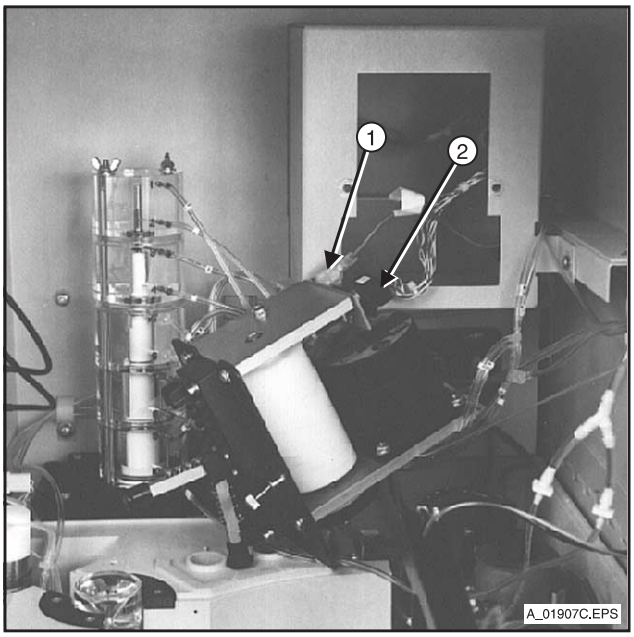
Figure 4-161. Captive Mounting Screws.

13. While holding the tubing aside with one hand, grasp the pinch valve assembly and remove it from the mounting location.

CAUTION

When removing the pinch valve, be careful not to catch any of the valve wiring on the sides of the valve opening. Damage may occur to the wiring.

14. Disconnect plug from socket on pinch valve assembly (Figure 4-162).



1 - Plug
2 - Ground Wire

Figure 4-162. “E” Pinch Valve Assembly Connectors.

15. Remove ground wire from valve by holding the plastic-coated portion of the connector and pulling it away from the ground lug.
16. Connect socket to plug on back of the new pinch valve assembly.
17. Attach the ground wire to ground lug.
18. While holding the tubing aside with one hand, place new pinch valve assembly into mounting position. Odd-numbered lines on the right, even-numbered lines on the left.
19. Tighten the two captive mounting screws.
20. Open pressure bars. Place all reagent lines into their respective pinch valve slots.

21. Close pressure bars. Make sure release-bar knob engages holder at each end of pressure bar, or finger-tighten the screws.

22. Open right-hand cabinet door. Press CX3 power switch to ON position. Close compartment door.

23. Turn the PC console power ON using the switch on the front of the console unit.

24. Reconnect lines labeled #2, #4, #6, and #84 to reagent bottles and wash bottle.

25. Prime the electrolyte buffer, CO_2 acid reagent, and electrolyte reference 20 times. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** Ratio Pump.

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

4.19 RATIO PUMP REMOVAL AND REPLACEMENT

1. Remove lines labeled #84, #6, #4, and #2 from the wash bottle and reagent bottles.

2. Prime the ratio pump 20 times to evacuate the lines. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** ratio pump.

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

3. From the MASTER Screen, press **SYSTEM IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"

4. Press **Y**. The screen will display:

    "SYSTEM IDLE" "CX3: STANDBY"
    "CONSOLE: " "CX4: STANDBY"

5. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure?"

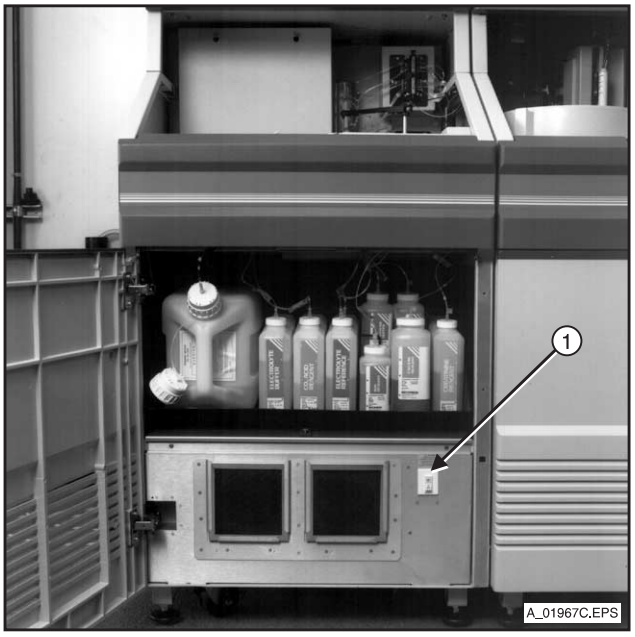
6. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).

7. Press **PREV SCREEN**. A window will pop up giving four boot options.

8. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."

    (a) Turn the PC console power OFF using the switch on the front of the console unit.

9. Turn CX3 power switch located behind the left front panel of the lower compartment to OFF position (Figure 4-163). Close compartment door.



1 - Power Switch

Figure 4-163. CX3 Power Switch

10. Disconnect the lines leading into the ratio pump (lines 1 through 10), by holding the top of the ratio pump with one hand and gently twisting the tubing while pulling outward with the other hand. Carefully remove ratio pump lines 5 and 6 to prevent damage to the fittings (Figure 4-164).

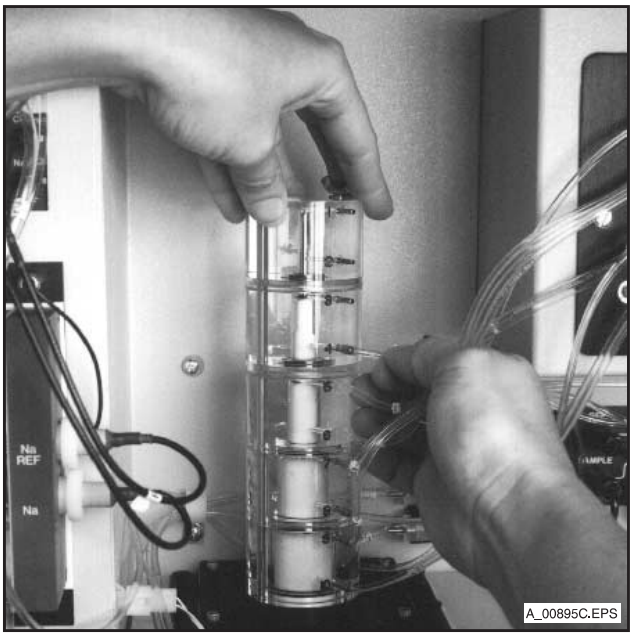
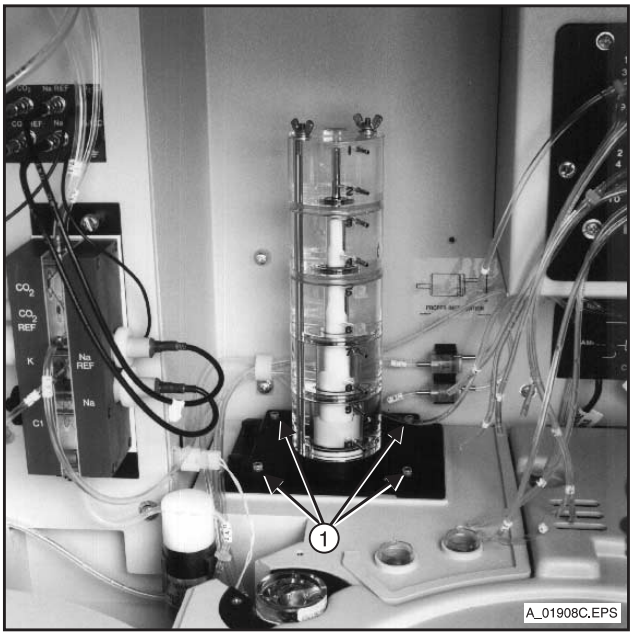


Figure 4-164. Disconnect Lines Leading to Ratio Pump

11. Pull up on all four mounting pins. Tilt pump forward and lift out (Figure 4-165).



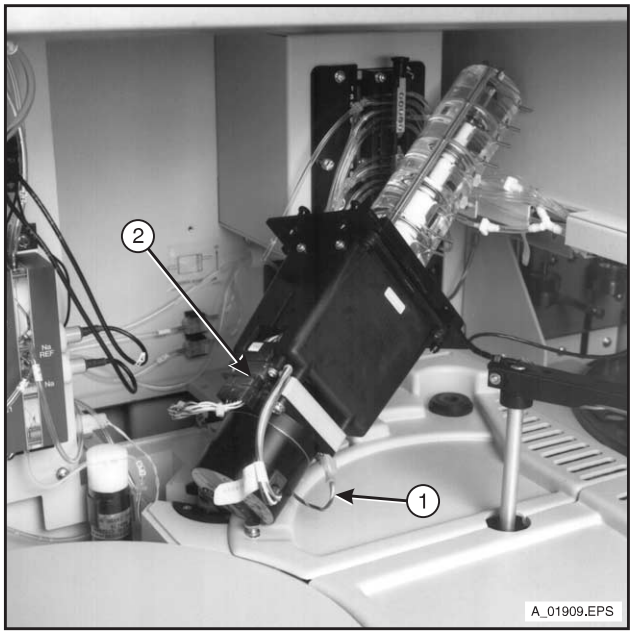
1 - Mounting Pins

Figure 4-165. Pull Up On Mounting Pins

NOTE

Do not allow connector or ground wire to fall inside of the instrument as retrieval may be difficult.

12. Grasp ground wire connector and gently pull away from ground lug (Figure 4-166).
13. Disconnect plug from socket on side of ratio pump (Figure 4-166).



1 - Ground Wire
2 - Plug

Figure 4-166. Disconnect Plug and Ground Wire

14. Reconnect socket and ground wire to new ratio pump.
15. Install ratio pump with reagent line connections facing toward the front of the instrument. Push down on all four mounting pins.
16. Reconnect lines 1 through 10 to ratio pump (refer to Figure 4-164).
17. Verify that wing nuts are finger-tight on top of the new ratio pump.
18. Reconnect reagent lines as follows:
    (a) #84 into Wash Solution
    (b) #4 into Electrolyte Buffer
    (c) #6 into Acid Reagent
    (d) #2 into Electrolyte Reference
19. Open left-hand cabinet door. Press CX3 power switch to ON position. Close compartment door.
20. Turn the PC console power ON using the switch on the front of the console unit.
21. Prime the ratio pump 20 times. Program the system as follows:

(a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

(b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

(c) Cursor and **SELECT** ratio pump.

(d) Press **F1 START PRIME**.

(e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

Check for leaks. Press **STOP** if any leaks are detected and repair.

4.20 SAMPLE CRANE REMOVAL AND REPLACEMENT

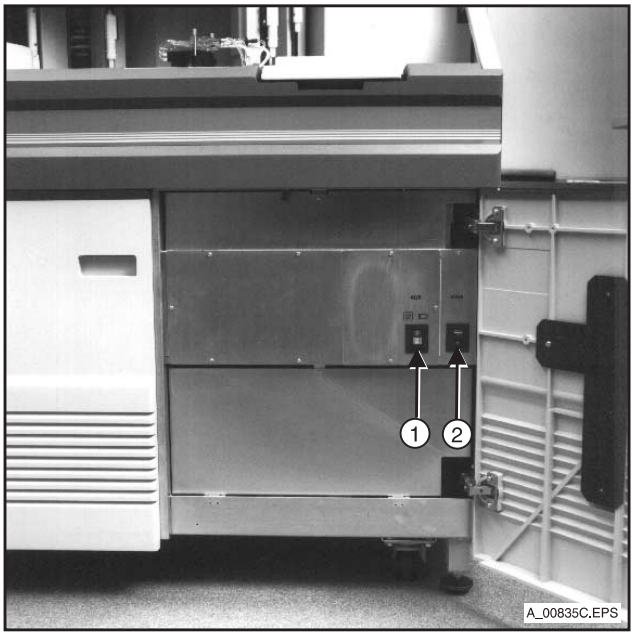
1. From the MASTER Screen, press **SYS IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"
2. Press **Y**, then **ENTER**. The screen will display:

   "SYSTEM IDLE" "CX3: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?"
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."

   (a) Turn the PC console power OFF using the switch on the front of the console unit.

7. Press MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-167). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

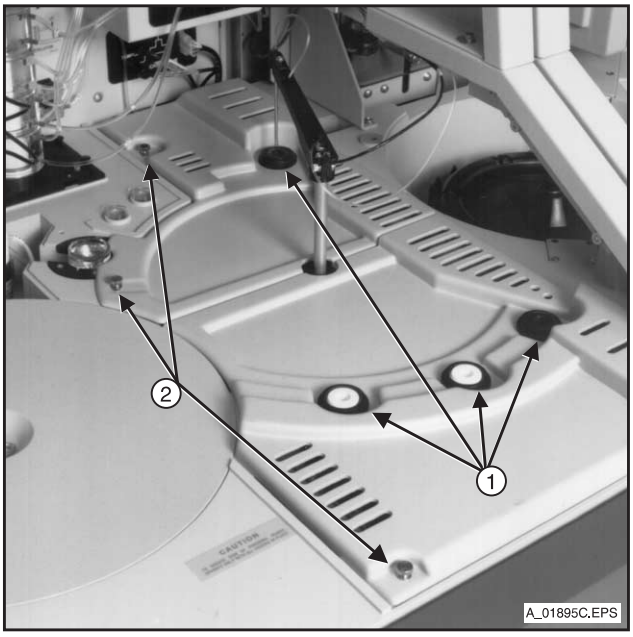
Figure 4-167. Power Switch

8. Before proceeding...

WARNING

TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

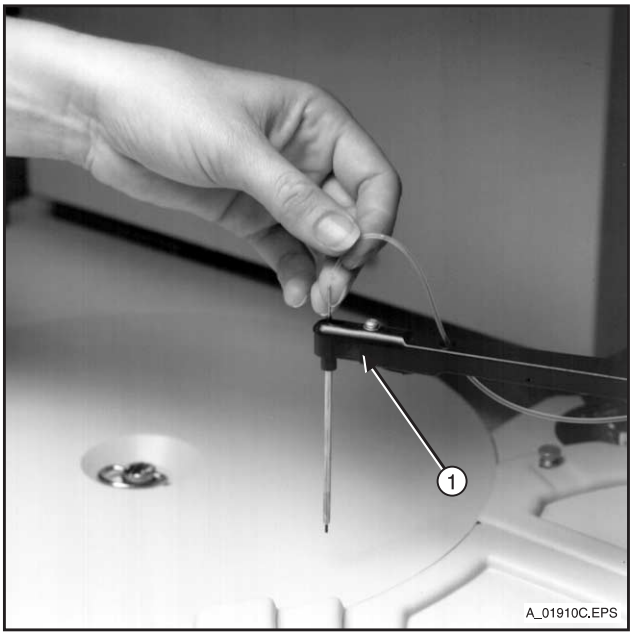
9. Unscrew all four retaining nuts and three retaining screws (Figure 4-168) and remove the chemistry cup shields.



1 - Retaining Nuts
2 - Retaining Screws

Figure 4-168. Remove Front and Rear Chemistry Cup Shields

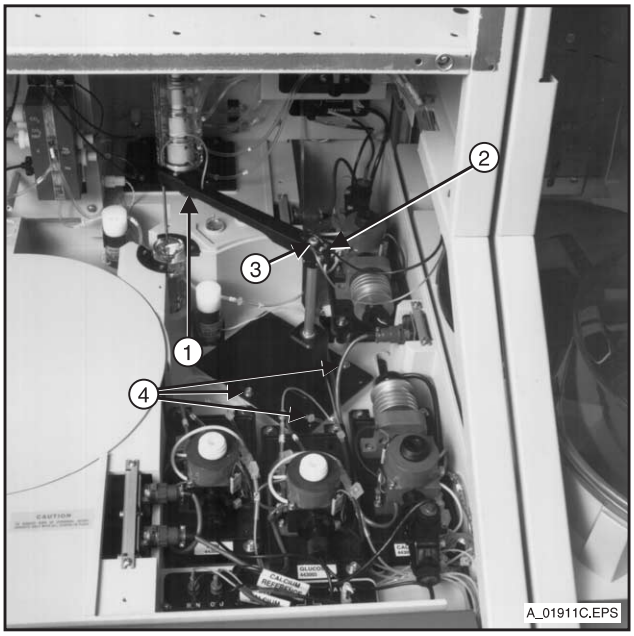
10. Disconnect the tubing from the top of the sample probe (Figure 4-169).



1 - Connector

Figure 4-169. CX3 Sample Probe

11. Disconnect the cable beneath the probe arm by gently grasping the connector and pulling it loose from the probe tip assembly (Figure 4-170).



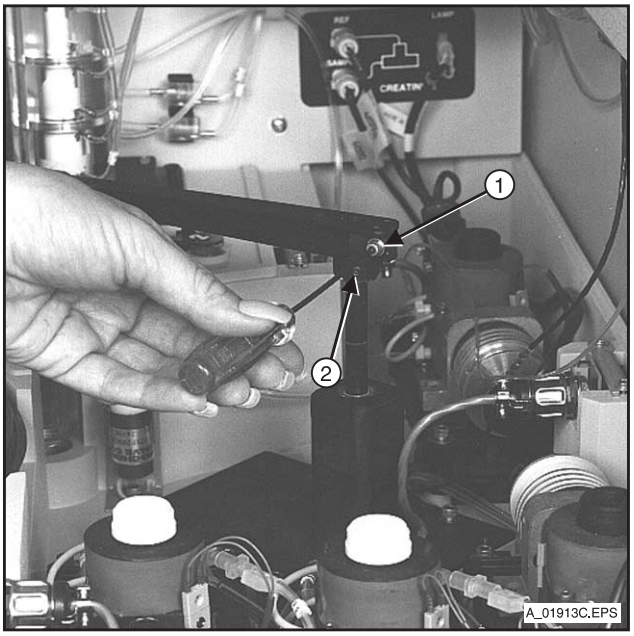
1 - Connector
2 - Tie Down
3 - Upper Socket Head Screw
4 - Base Socket Head Screws

Figure 4-170. Disconnect Cables Beneath Probe Arm

12. Pull tubing and cable through the back of the probe arm (Figure 4-171). Loosen cable from tie down on end of sample probe arm (Refer to Figure 4-170).

Figure 4-171. Pull Tubing and Cable Through Back of Probe Arm

13. Use a socket head wrench (7/64 inch) to loosen the upper socket-head screw located at the back of the probe arm (Figure 4-172).



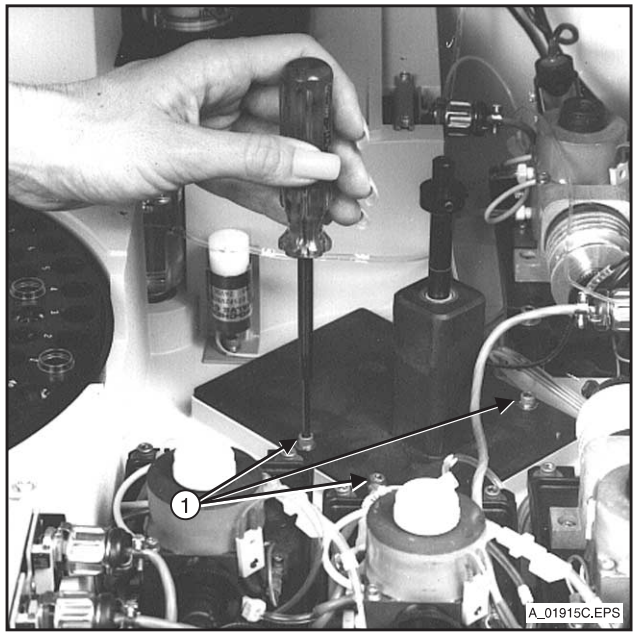
1 - Upper Socket Head Screw
2 - Socket Head Screws (2) on Crane Shaft Collar

Figure 4-172. Loosen Upper Socket-Head Screw

14. Lift probe arm from crane shaft (Figure 4-173).

Figure 4-173. Removing Probe Arm

15. Use a 9/64 inch socket head wrench to remove the four socket head screws from the base of the crane assembly (Figure 4-174).



1 - Socket Head Screws

Figure 4-174. Remove Socket-Head Screws from Base of Crane Assembly

16. Remove the crane assembly from the system by slowly lifting up and out.

17. Disconnect large black socket from plug located on bottom of the crane assembly.
18. Unplug the ground wire from the crane assembly.
19. Attach the ground wire to the new crane assembly.
20. Connect the socket to the plug on the new crane assembly.
21. Lower the crane assembly into position. Take care not to pinch any lines or tubing during installation. Install the four socket head screws onto the base of the crane assembly.
22. Thread the wire DOWN through the hole in the probe arm as indicated in Figure 4-173. Install the probe arm on the new crane assembly (Refer to Figure 4-171).
23. Temporarily tighten the upper socket head screw (Refer to Figure 4-172).
24. Reconnect the wires beneath the probe arm by gently grasping the connector and pushing it onto the probe tip assembly.
25. Thread the probe tubing downward through the top of the new probe arm, then back up through the opening at the front of the arm. Reattach tie down (and cable) to end of sample probe arm (Refer to Figure 4-170). Connect tubing to fitting at the top of the probe (Refer to Figure 4-171).
26. Carefully place chemistry cup shields over the reaction cups. Be careful not to pinch wires or tubes under the cover.
27. Install the four large black retaining nuts and three retaining screws finger-tight on top of the chemistry cup shields (Refer to Figure 4-168).
28. Reconnect system power cord to power source.
29. Press system MAIN power switch to the ON position and allow the system to reboot.
30. Turn the PC console power ON using the switch on the front of the console unit.
31. Perform diagnostics (Paragraphs 3.5.12 and 3.5.13) Sample Probe Height and Centering Alignment and Sample Carousel/CX3 and ISE Probe Alignment.

NOTICE

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.21 SAMPLE PROBE REPLACEMENT (CX3)

1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.
2. Disconnect tubing from top of sample probe (Figure 4-175).

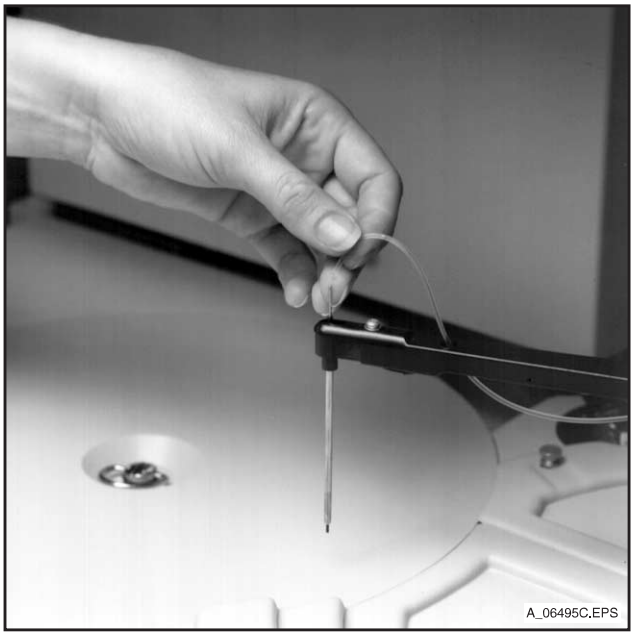
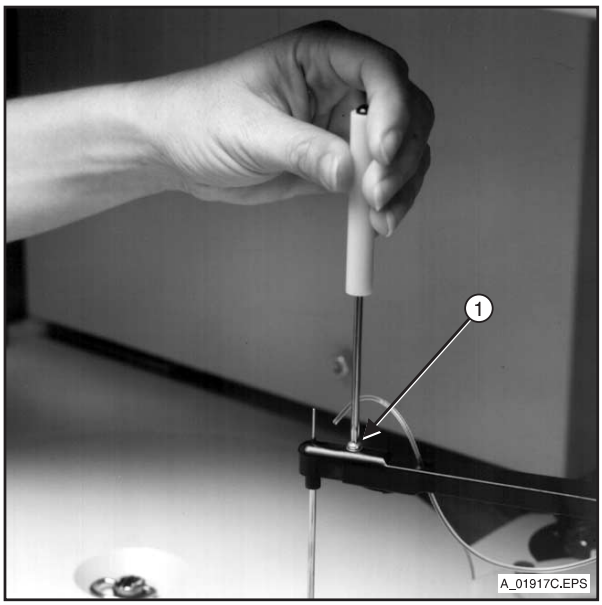


Figure 4-175. CX3 Sample Probe

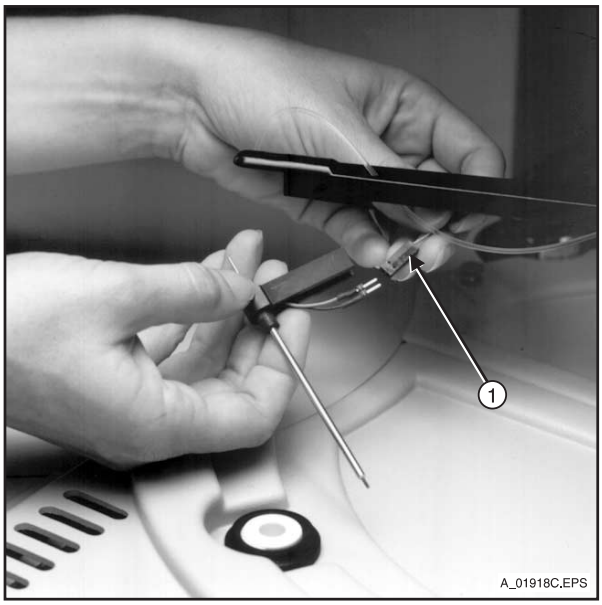
3. Using a small Phillips screwdriver, remove the retaining screw on top of the probe arm (Figure 4-176).



1 - Retaining Screw

Figure 4-176. Remove Retaining Screw.

4. Carefully grasp the probe tip assembly and pull it down and away from the probe arm.
5. Disconnect the wires beneath the probe arm by gently grasping the connector and pulling it apart (Figure 4-177). Discard old probe assembly.



1 - Probe Connector

Figure 4-177. Disconnect Wires Beneath Probe Arm

6. Reconnect the new probe assembly wires beneath the probe arm by gently grasping the connector and pushing it into the probe plug.
7. Install new probe assembly by inserting top of probe up through probe arm.
8. Install screw on top of the probe arm. Leave screw loose for final adjustment.
9. Manually position crane arm over the electrolyte injection cup (EIC).

NOTE

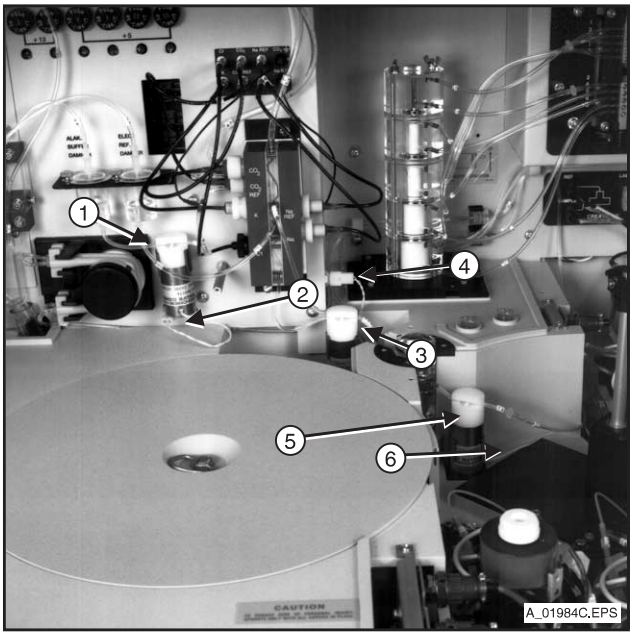
Use crane shaft to move probe up and down.

10. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize.
11. Perform CX3 probe alignment procedures. For instructions, refer to Paragraph 3.11.2 followed by 3.5.12 and 3.5.13.

4.22 SOLENOID VALVE REPLACEMENT

1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 9. CX3 Prevent Autoprime or type **9** and **ENTER**.

2. Using a hemostat, securely clamp the line going through the defective solenoid approximately one inch (25 mm) from the solenoid (Figure 4-178).



1 - Alkaline Buffer Solenoid Valve
2 - Alkaline Buffer Solenoid Valve Connector
3 - Flow Cell Solenoid Valve
4 - Flow Cell Solenoid Valve Connector
5 - Electrolyte Injection Solenoid Valve
6 - Electrolyte Injection Solenoid Valve Connector Wire

Figure 4-178. Location of Solenoid Valves

3. Grasp the tubing on both sides of the solenoid and gently pull the tube out of the solenoid.
4. Disconnect the appropriate solenoid cable from the connector (Figure 4-178).
5. Remove solenoid from mounting clamp by firmly grasping the solenoid and pulling. Discard defective solenoid.
6. Install new solenoid valve. Snap it into the mounting in the same orientation as the one just removed.
7. Plug solenoid connector into appropriate connector as follows:
   (a) Electrolyte Injection Cup Solenoid - J1701
   (b) CO_2 Alkaline Buffer Solenoid - J1702
   (c) Flow Cell Solenoid - J1703
8. Install tubing in solenoid by holding the tubing on either side of the solenoid and working it into place.
9. Remove hemostat from tubing.
10. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
11. Prime appropriate plumbing system as follows:
    (a) If the CO_2 alkaline buffer solenoid was replaced, prime "CO_2 Alkaline Buffer" three times.
    (b) If the flow cell pinch valve solenoid was replaced, prime "Ratio Pump" three times.
    (c) If the electrolyte injection cup solenoid valve was replaced, prime "Wash Solution" three times.
12. Check for leaks while priming. Stop priming and repair any observed leaks.

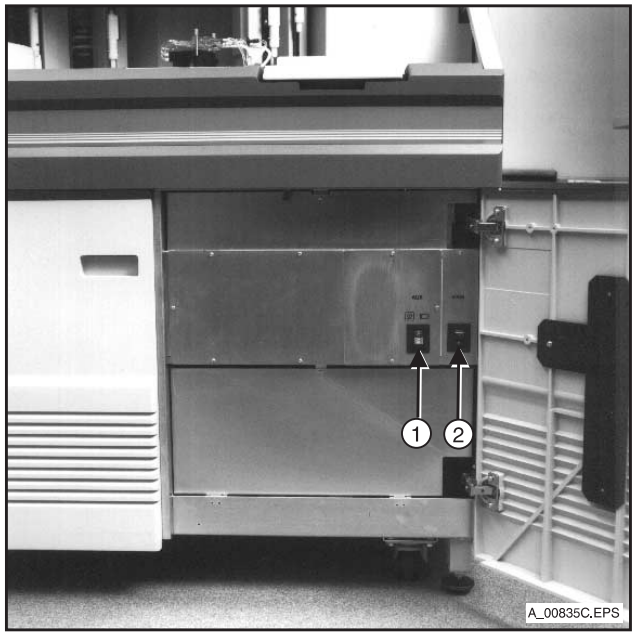
4.23 SOURCE LAMP REMOVAL AND REPLACEMENT

1. Assure the system is in STANDBY. From the Master Screen, press **SYS IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"
2. Press **Y**, then **ENTER**. The screen will display:

   "SYSTEM IDLE" "CX3: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt: "This will reboot the system. Continue with the Resume procedure (Y/N)?"
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <PREV SCREEN> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.
6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."
   (a) Turn the PC console power OFF using the switch on the front of the console unit.

7. Press MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-179). Leave AUX power switch ON. The green power switch light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

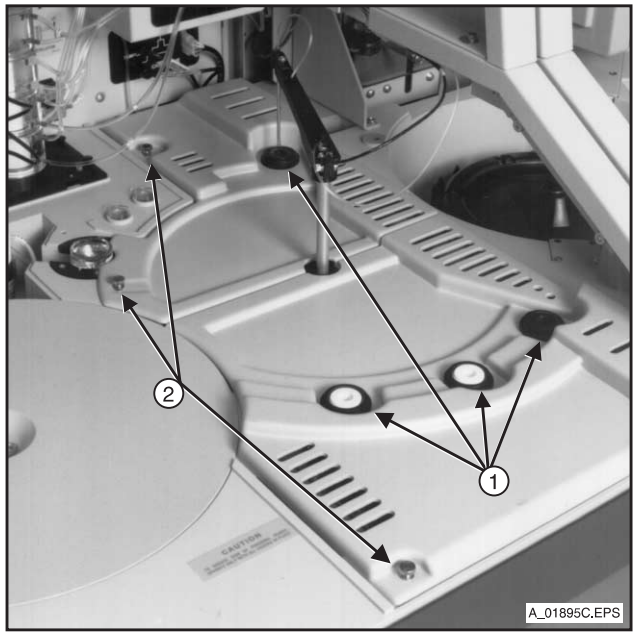
Figure 4-179. Power Switches

8. Before proceeding...

WARNING

TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

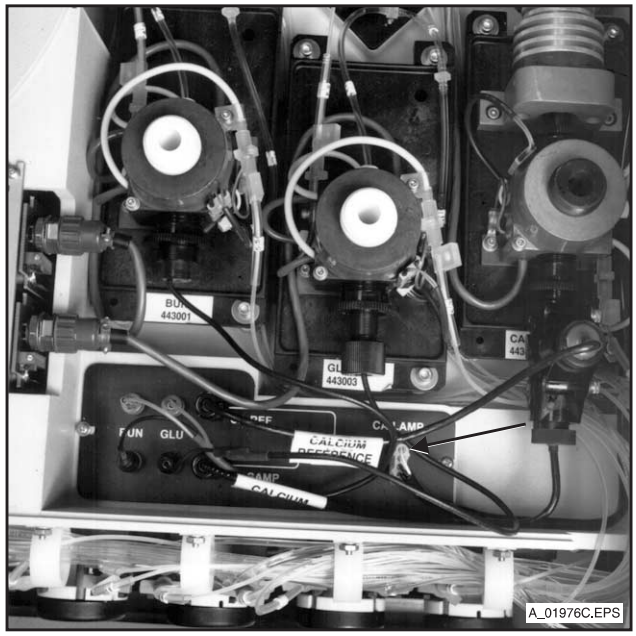
9. Unscrew all four retaining nuts and three retaining screws (Figure 4-180) and remove the chemistry cup shields.



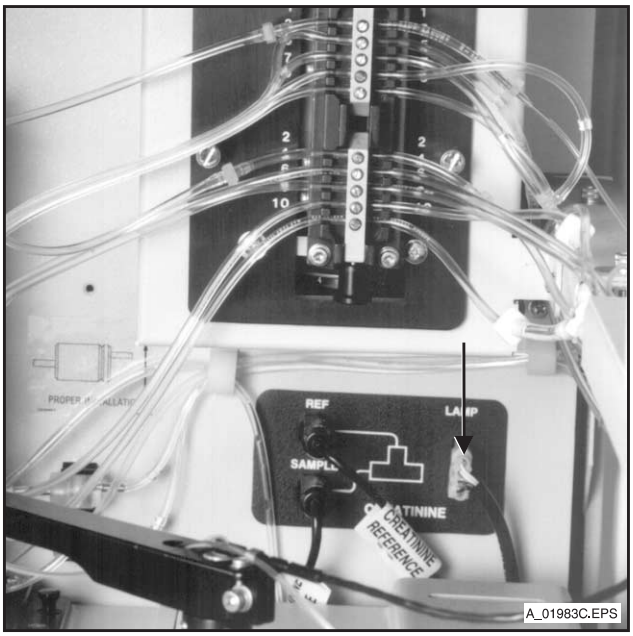
1 - Retaining Nuts
2 - Retaining Screws

Figure 4-180. Remove Front and Rear Chemistry Cup Shields

10. Unplug source lamp connector from appropriate panel (Figure 4-181 A and B). To do this, pull connector straight out until pins disengage. DO NOT pull on wire portion of connector.

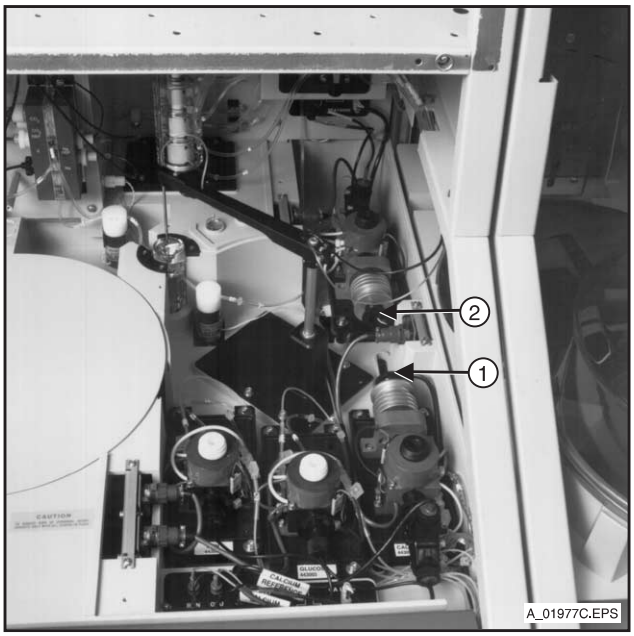


A. Calcium or Total Protein Lamp Connector



B. Creatinine Lamp Connector

Figure 4-181. Source Lamp Connectors



1 - Total Protein (or Calcium) Source Lamp Retaining Collar
2 - Creatinine Source Lamp Retaining Collar

Figure 4-182. Black Source Lamp Retaining Collars

WARNING

The lamp housing may be very hot. To avoid possible burns, DO NOT TOUCH.

11. Unscrew black source lamp retaining collar at rear of total protein (or calcium) or front of creatinine module (Figure 4-182). Remove and discard lamp assembly (lamp, retaining collar, and connector).

12. Carefully unpack new lamp assembly.

CAUTION

Be sure to keep all light pathways clean and free of debris. Fingerprints, grease, and dust will adversely affect performance. If necessary, use a lint-free cloth dampened with isopropanol to clean lamps.

13. Insert new lamp assembly into rear of total protein (or calcium) or front of creatinine module. Finger-tighten black retaining collar.
14. Align source lamp connector pins with receptacle on connector panel. (Connector will only fit one way.) Push in until snug.
15. Check to make sure that all lamp connectors are properly plugged in.
16. Replace chemistry cup shields, all four retaining nuts and the three retaining screws.
17. Reconnect system power cord to power source.
18. Press system MAIN power switch to the ON position.
19. Turn the PC console power ON using the switch on the front of the console unit.

20. Allow the lamp to warm up for 30 minutes before continuing.
21. Proceed to Paragraph 4.23.1 and perform the lamp test prior to calibration and operation of this channel.

NOTICE

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.23.1 CX3 Lamp Test

1. Access the test as follows:
   (a) From the MASTER Screen press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type 6 and **ENTER**.
   (c) Cursor and **SELECT** 8. CX3 Lamp Test or type **8** and **ENTER**.
2. At this point the lamp in the cup should be off. Check the ranges for the total protein (or calcium) and creatinine lamps and then make the appropriate potentiometer adjustments on Analog Board 3. The arrow on the screen points to the potentiometer to adjust.

NOTE

Stabilization of 0%T may take up to 3 minutes before adjustments can be made

To adjust the potentiometers remove the electronics compartment cover and locate Analog Board 3.

The total protein (or calcium) potentiometer R14 is located above the P303 connector and the creatinine potentiometer is located above the P304 connector on the analog board. Make the adjustment until the screen display millivolt values fall within range. Counterclockwise adjustments will cause the numbers to become more negative.

3. From the 0% Adjustment Screen press **F1 100% T**.

NOTE

In going from the 0% T to 100% T Lamp Adjust Screens, there will be a delay of about 90 seconds to allow the lamp to stabilize before adjustments are made. This stabilizing screen will only appear when accessing the 100% T Screen directly from the 0% T Screen.

4. The system will drain the total protein (or calcium) and creatinine cups. The system will then prompt the operator to fill the reaction cups with distilled water. After filling the reaction cups the operator presses **F1 CONTINUE**.
5. The operator is then prompted to fill the reaction cup with distilled water, then press **F1 CONTINUE**.
6. For the creatinine lamp adjustments, follow the instructions on the screen carefully. Make adjustments to the reference potentiometers first.
7. Make the appropriate adjustments to the voltage values on the screen. Make adjustments only to potentiometers that are pointed to by arrows on the screen.
8. To make the 100% T total protein (or calcium) adjustment press **F1 100% T**. To return to the 0% T adjustment press **F2 0% T**.
9. To make the potentiometer adjustments the electronics compartment cover must be removed. The potentiometers are located on Analog Board 3 in the same order as displayed on the screen.
10. If either of the following conditions exist proceed to Paragraph 4.23.2 (Lamp Shutter Adjustment Procedure).
    (a) The reference voltage cannot be adjusted to 4.9990 volts with either potentiometer R8 (Total Protein or Calcium) or R22 (Creatinine)
    (b) The calcium or creatinine reference voltage cannot be adjusted below 10.010 volts with potentiometer R8 (Total Protein or Calcium) or R22 (Creatinine).
11. To exit the Lamp Adjust Screen, press **PREV SCREEN**. The screen will prompt: “Exit this procedure Y/N?”
12. Press **Y** then **ENTER**. Allow the system to stabilize, then press **MASTER SCREEN**.

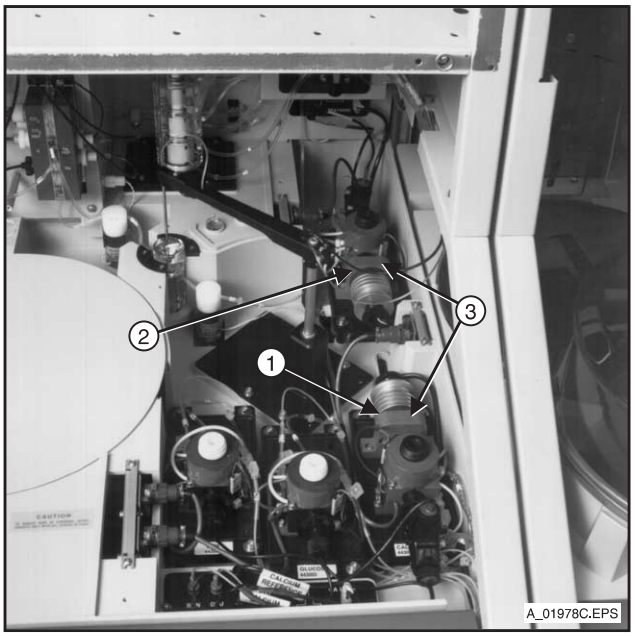
4.23.2 Lamp Shutter Adjustment Procedure

This procedure is used to adjust the amount of lamp energy that strikes the detectors of the CX3 creatinine and total protein (or calcium) modules. This adjustment is necessary if one of the following conditions exists after installing a new lamp.

1. The reference voltage cannot be adjusted to 4.9990 volts with either potentiometer R8 (Total Protein or Calcium) or R22 (Creatinine).
2. The total protein (or calcium) or creatinine reference voltage cannot be adjusted below 10.010 volts with potentiometer R8 (Total Protein or Calcium) or R22 (Creatinine).

Adjustment Procedure

The shutters are located inside the heatsink brackets of the total protein or calcium and creatinine reaction cup modules (Figure 4-183). These brackets have access from both sides of the module. To adjust, use a small straight slot screwdriver (Figure 4-184).



1 - Total Protein (or Calcium) Lamp Shutter
2 - Creatinine Lamp Shutter
3 - Heatsink Brackets

Figure 4-183. Lamp Shutters

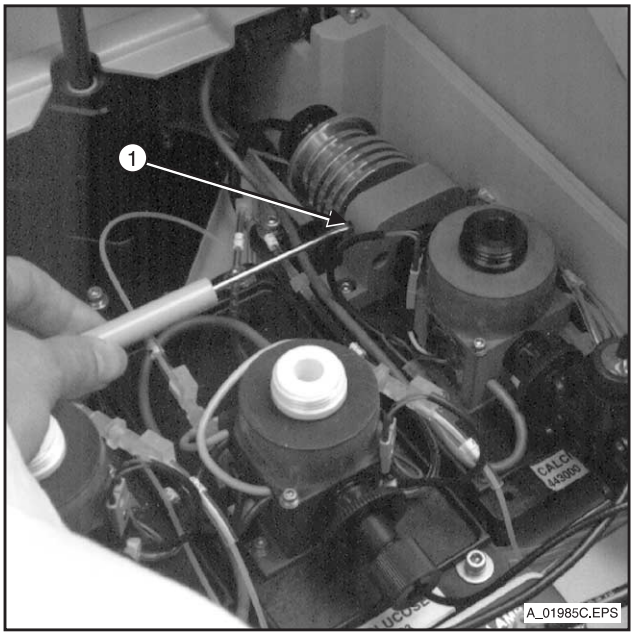


Figure 4-184. Adjust Shutter

NOTICE

This procedure should be done only if a new lamp is not available for installation and attempts to adjust the lamp to the proper voltage with the potentiometers are unsuccessful.

1. Access the lamp adjustment procedure as follows:
2. Follow the instructions on the CRT to prepare the total protein (or calcium) and/or creatinine module for the 100% T lamp adjustment.
3. Adjust the lamp shutter for the respective module if the reference voltage is less than 4.9999 volts and cannot be adjusted to a higher voltage with the respective potentiometer.
4. Turn the screw counterclockwise to open the shutter to allow more light to pass through the shutter.
5. If the lamp voltage is too high (greater than 10.010 volts) and adjustment with the respective calcium or creatinine circuit board potentiometer does not lower the voltage, turn the screw in the lamp heat sink clockwise. This will reduce the amount of light striking the sensor.

NOTICE

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.24 STIRRER MOTOR REMOVAL AND REPLACEMENT

Refer to Paragraph 4.11.1 or 4.11.2 for removal and replacement procedures for individual modules: BUN, glucose, total protein (or calcium), or creatinine.

1. Remove module per Paragraph 4.11.1, Steps 1 through 20 for BUN or Glucose, or Paragraph 4.11.2, Steps 1 through 21 for Creatinine Total Protein (or Calcium) Stirrer Motor replacement.
2. Remove stirrer from reaction cup (Figure 4-185).

NOTE

When removing stirrer:

(a) Remove electrodes from BUN or glucose module prior to stirrer removal. Set electrode (if applicable) and stirrer aside for later reinstallation.

(b) Be careful not to scratch total protein (or calcium) or creatinine detectors.

(c) **NEVER INTERCHANGE STIRRERS** between reaction cups.

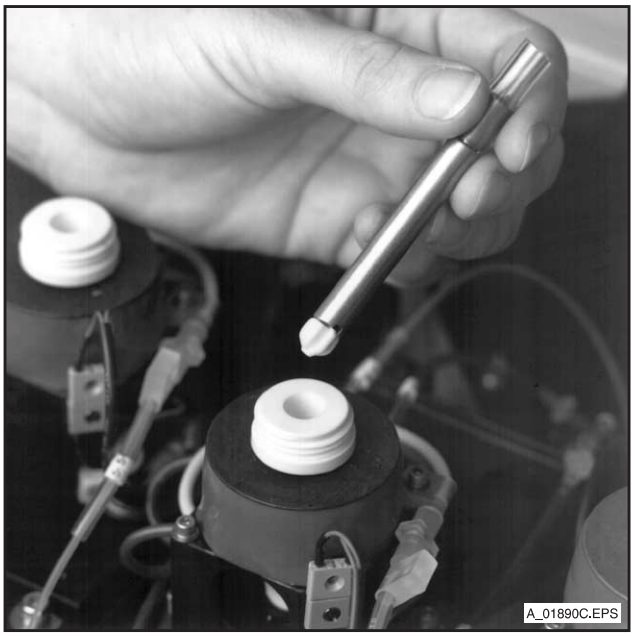
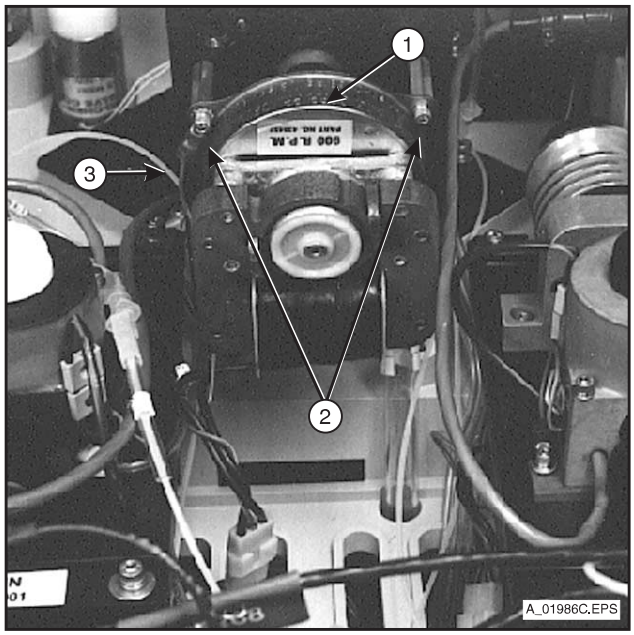


Figure 4-185. Remove Stirrer from Reaction Cup

3. Turn module upside down and remove the three motor retaining screws which hold the motor assembly to the bottom of the module (Figure 4-186).



1 - Stirrer Motor
2 - Module Retaining Screws
3 - Ground Wire

Figure 4-186. Stirrer Motor

4. Remove old motor assembly.

5. Position new motor on bottom of module so that the screw holes are aligned.

NOTE

BUN, creatinine, and calcium use a 720 rpm motor assembly. Glucose and total protein use a 900 rpm motor assembly.

6. Install the three motor retaining screws. Be sure to put the ground wire between the attaching screw and the motor.
7. Refer to Paragraph 4.11.1, Steps 22 through 27 for BUN or Glucose, or Paragraph 4.11.2, Steps 25 through 31 for Creatinine or Total Protein (or Calcium) module installation instruction.

NOTE

When reinstalling chemistry reaction cup module, be sure to properly align module with the sample probe. This will prevent any damage from occurring to the sample probe or reaction cup.

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

8. Install the stirrer.
9. Install the BUN or glucose electrode (if applicable)

NOTE

Prior to installation:

(a) The glucose electrode should be recharged (and installed) according to the procedure in Paragraph 4.15.5, Steps 7 through 9 (Glucose Electrode Removal and Replacement).

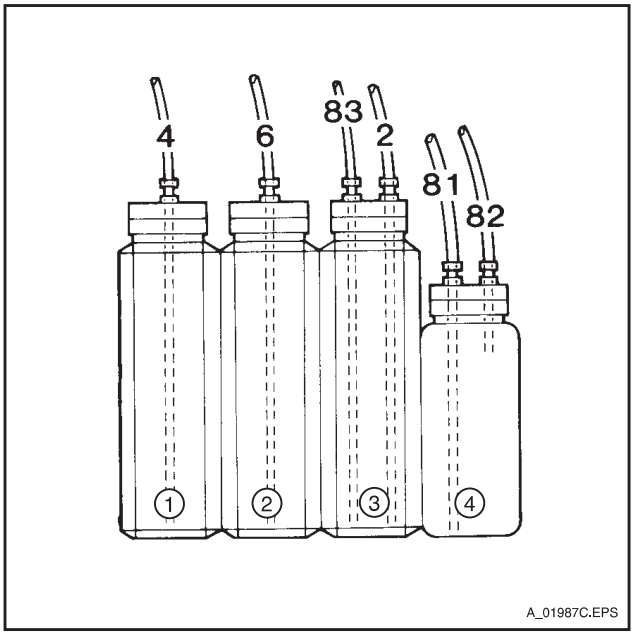
(b) The BUN electrode should be cleaned and prepared according to the procedure in Paragraph 4.15.1, Steps 7 through 16 (BUN Electrode Removal and Replacement).

4.25 "C" AND "E" PINCH VALVE ASSEMBLY ADJUSTMENT

4.25.1 "E" Cam Pinch Valve Adjustment

The "E" Cam Pinch Valve should not require frequent adjustment. However, if you should experience difficulty or a Beckman Technical Representative instructs you to adjust this part, perform the following procedure:

1. Remove lines labeled #84, #4, #6 and #2 from the wash solution and reagent bottles (Figure 4-187).
2. Prime the electrolyte buffer, CO_2 acid reagent, electrolyte reference reagent, and wash solution 20 times. Program the system as follows:
   (a) From the Special Function Screen, select **1**. PRIME. Cursor and select BUN3, GLU3, CRE3, TP3 (or CA3), Wash Solution, Ratio Pump, and CO_2 Alkaline Buffer.
   (b) Press **F1 START PRIME**. Type the Number of primes desired (20).
   (c) The Prime Screen will then indicate the number of primes remaining. The prime cycles are completed when CX3 status displays Stand By.



1 - Electrolyte Buffer
2 - CO_2 Acid Reagent
3 - Electrolyte Reference
4 - Alkaline Buffer

Figure 4-187. Removing/Attaching Reagent Bottle Lines

3. Press **SYS IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"

   (a) Press Y, the ENTER. The screen will display:

   "SYSTEM IDLE" "CX3: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

   (b) Press **F4 RESUME**. The screen will prompt "This will reboot the system. Continue with the Resume procedure (Y/N)?"

   (c) Press **Y**, then **ENTER**. The message window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).

   (d) Press **PREV SCREEN**. A window will pop up giving four boot options.

   (e) Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."

   (f) Turn the PC console power OFF using the switch on the front of the console unit.

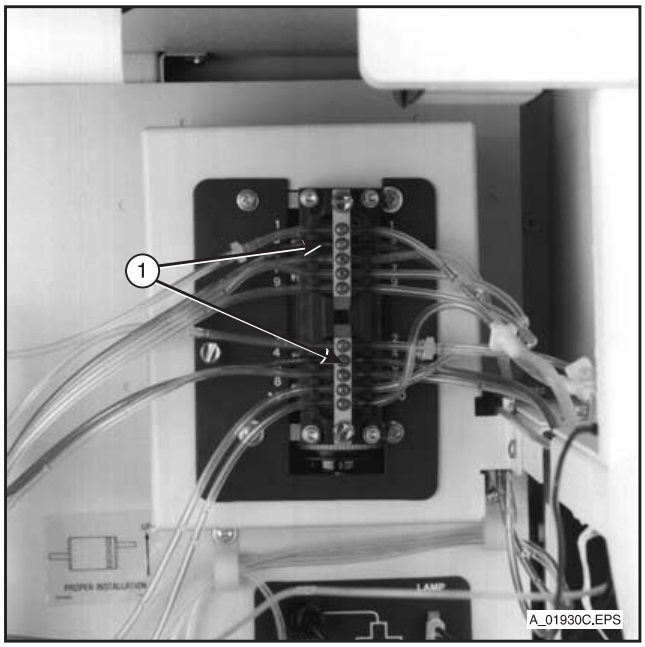
   (g) Press MAIN power switch behind the right front panel of the lower compartment to OFF. Leave AUX power switch ON. The green power light will go out. Close compartment door.

4. Before proceeding...

WARNING

TO PREVENT ELECTRICAL SHOCK, DISCONNECT SYSTEM POWER CORD FROM POWER SOURCE.

5. Release pressure bars on "E" Cam Pinch Valve assembly by loosening the screws and then lifting the pressure bars or, pulling the black release knob out and moving the pressure bars away from the tubing (Figure 4-188). Remove all the tubing (lines 1 through 10) from the pinch valve assembly.



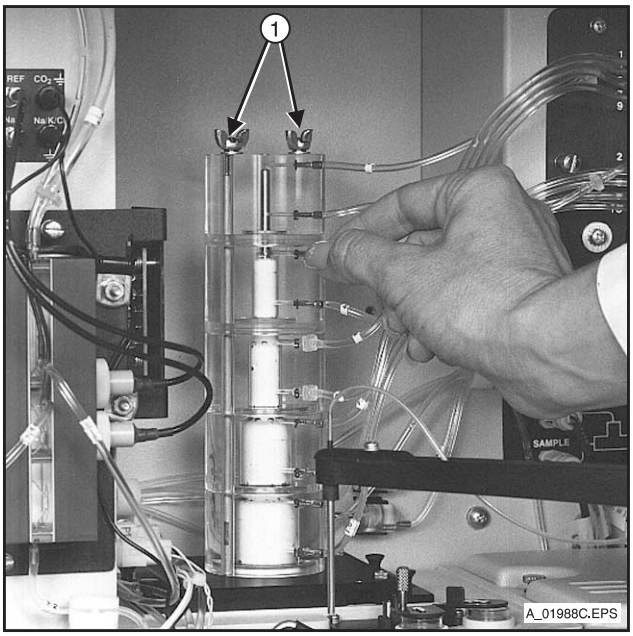
1 - Pressure Bars

Figure 4-188. Opening/Closing Pressure Bar

6. If necessary (to facilitate pinch valve removal) disconnect lines 1 through 10 leading into the ratio pump (Figure 4-189). Hold top of ratio pump while gently twisting to remove each line.

CAUTION

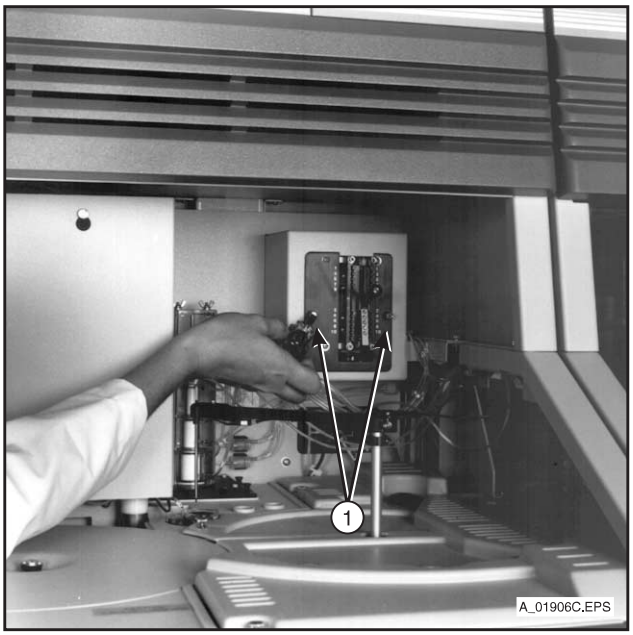
Care must be taken when removing or replacing lines 5 and 6 from the ratio pump (Figure 4-189) as damage may occur to the fittings.



1 - Wing Nuts

Figure 4-189. Removing/Attaching Ratio Pump Lines

7. While holding the assembly in place with one hand, unscrew the two captive mounting screws (Figure 4-190).



1 - Captive Mounting Screws

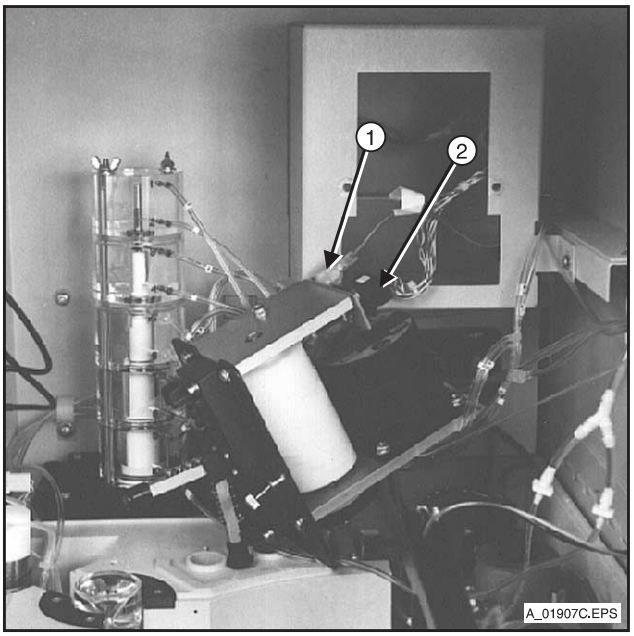
Figure 4-190. Captive Mounting Screws

8. While holding the tubing aside with one hand, grasp the pinch valve assembly and remove it from the mounting location (Figure 4-191).

CAUTION

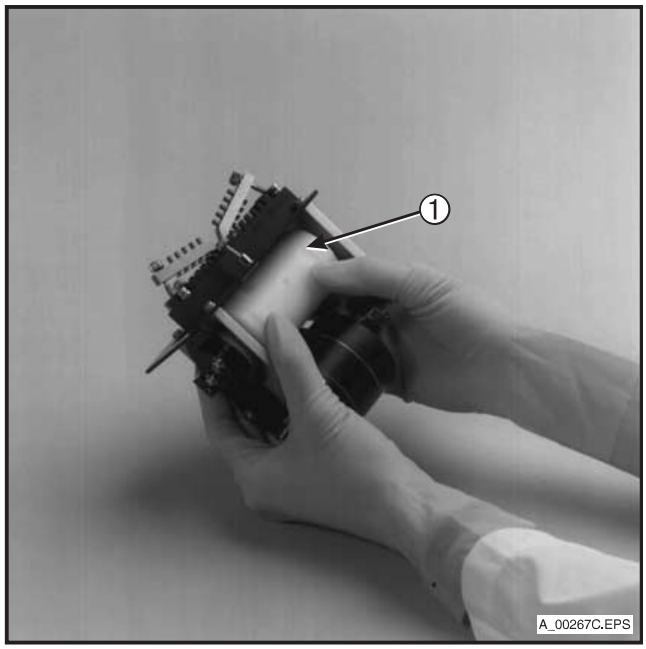
When removing pinch valve, be careful not to catch any of the valve wiring on the sides of the valve housing as damage may occur to the wiring.

9. Disconnect socket from plug on back of pinch valve assembly (Figure 4-191).
10. Remove ground wire from valve by holding the plastic coated portion of the connector and pulling it away from the ground lug (Figure 4-191).



1 - Ground Wire
2 - Plug

Figure 4-191. Removing/Replacing Pinch Valve “E” Assembly and Connectors



1 - Cam

Figure 4-192. Rotating the Cam

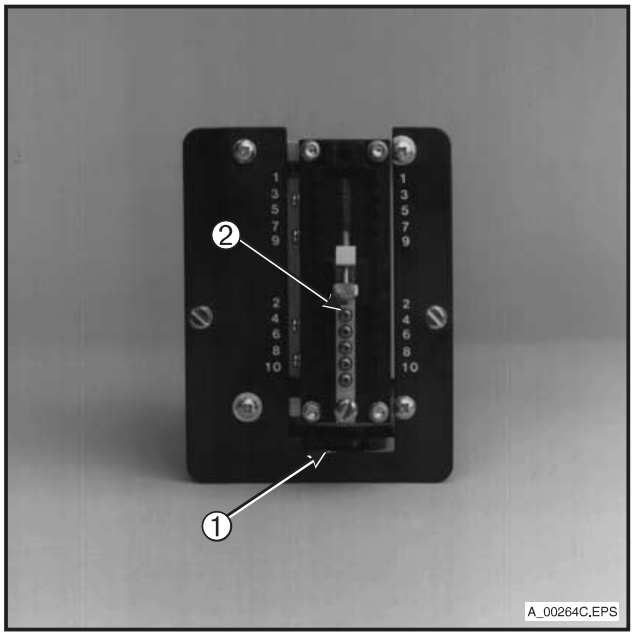
ADJUSTING LINE POSITIONS 1, 3, 5, 7, and 9

11. Manually rotate cam until the number “3” is positioned in the center of the opening below the lower pressure bar (Figures 4-192 and 4-193).

12. Close pressure bar.

CAUTION

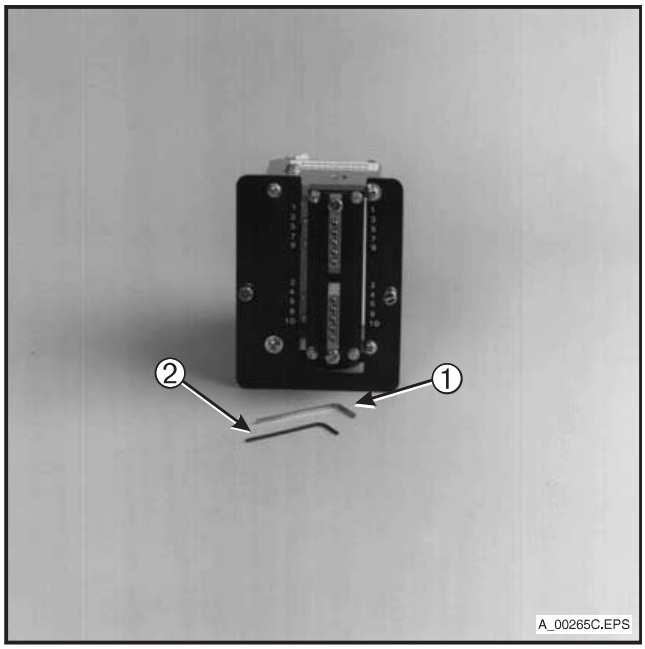
Do not forcibly insert or remove gauges as damage to cam plungers may result.



1 - Cam Position “3”
2 - Line Adjustment Screws

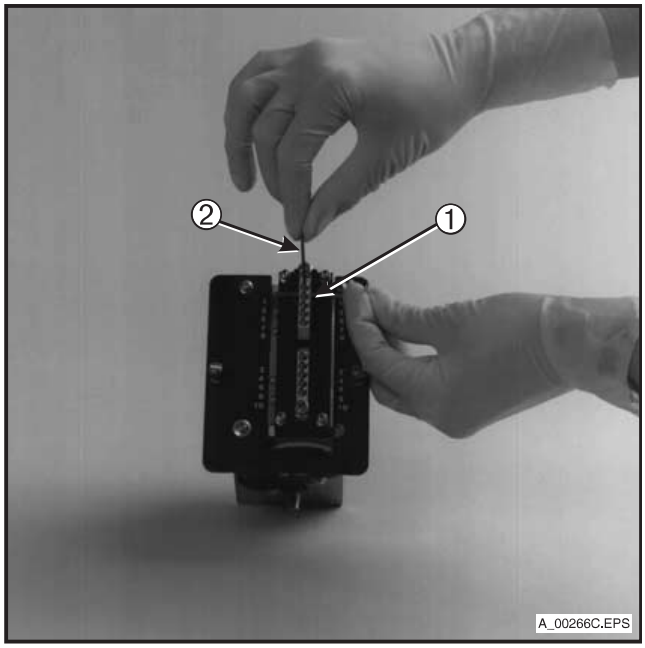
Figure 4-193. Cam Position “3”

13. Insert the adjustment gauge (PN 450968) individually into line positions 1, 3, 5, 7, and 9 (Figure 4-194). Start with position 1; turn adjustment screw clockwise until it makes contact with the adjustment gauge (Figure 4-195). Gently slide gauge in and out. Slight resistance should be felt.



1 - Adjustment Gauge
2 - Line Adjustment Tool

Figure 4-194. Cam and Adjustment Tools



1 - Line Adjustment Screw
2 - Line Adjustment Tool

Figure 4-195. Tightening Line Adjustment Screws

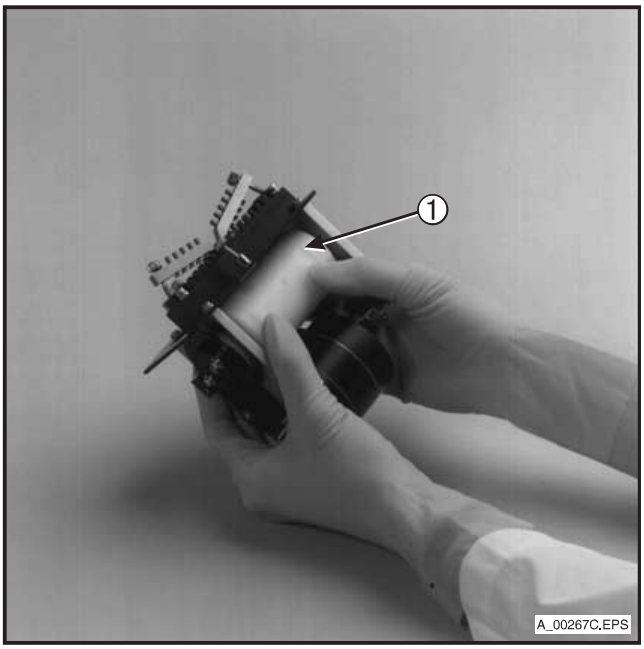
ADJUSTING LINE POSITIONS 2, 4, 6, 8, and 10

14. Manually rotate cam until the number “1” is positioned in the center of the opening below the lower pressure bar (Figures 4-196 and 4-197).

15. Close pressure bar.

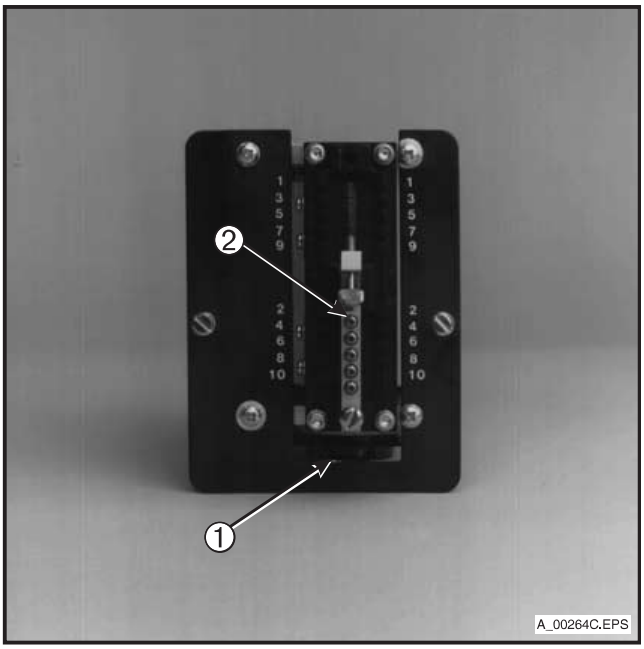
CAUTION

Do not forcibly insert or remove gauges as damage to the cam may result.



1 - Cam

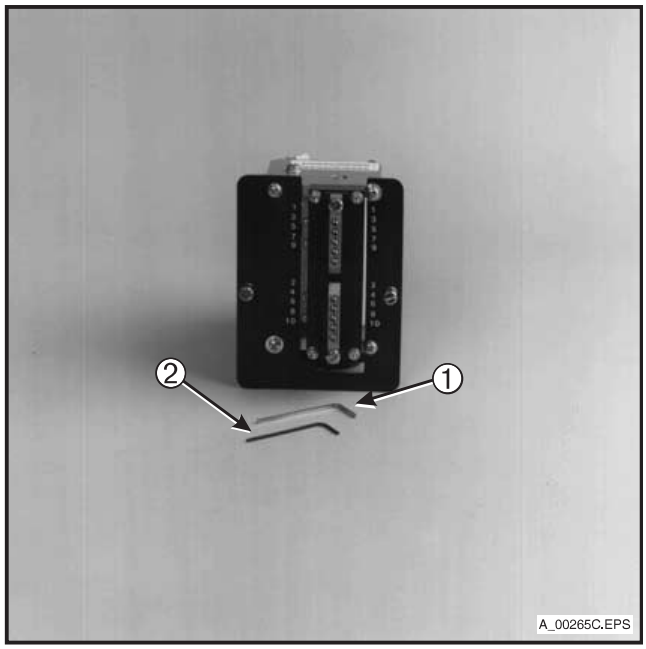
Figure 4-196. Rotating the Cam



1 - Cam Position “1”
2 - Line Adjustment Screws

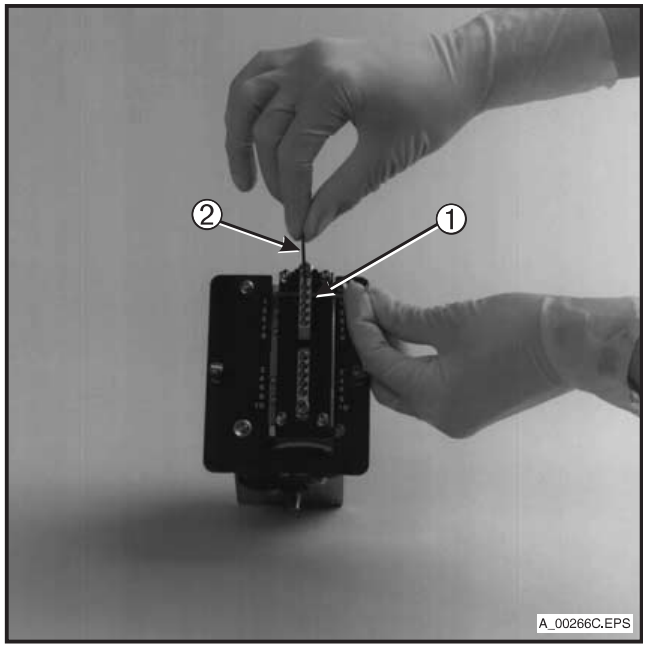
Figure 4-197. Cam Position “1”

16. Insert the adjustment gauge (PN 450968) individually into line positions 2, 4, 6, 8, and 10 (Figure 4-198). Start with position 2; turn adjustment screw clockwise until it makes contact with the adjustment gauge (Figure 4-199). Gently slide gauge in and out. Slight resistance should be felt.
17. Connect socket to plug on back of pinch valve “E” Cam.
18. Attach the ground wire to ground lug.
19. While holding tubing aside with one hand, place pinch valve assembly into mounting position.
20. While holding the pinch valve assembly in place with one hand, tighten the two captive mounting screws.
21. If lines 1 through 10 were removed from the ratio pump, hold the top of the ratio pump with one hand and reconnect lines 1 through 10 to ratio pump.
22. Open pressure bars. Place reagent lines (1 through 10) into their respective pinch valve slots.
23. Close pressure bars.
24. Reconnect reagent lines as follows:
    (a) #4 into electrolyte buffer
    (b) #6 into CO_2 acid reagent
    (c) #2 into electrolyte reference
    (d) #84 into wash solution
25. Reconnect system power cord to power source.
26. Press system Main power switch to the ON position and allow the system to reboot.
27. Turn the PC console power ON using the switch on the front of the console unit.



1 - Adjustment Gauge
2 - Line Adjustment Tool

Figure 4-198. Cam and Adjustment Tools



1 - Line Adjustment Screw
2 - Line Adjustment Tool

Figure 4-199. Tightening Line Adjustment Screws

28. Prime the ratio pump 20 times.
29. Inspect the system for leaks during priming. Stop priming if any leaks are noticed and correct the problem.

NOTICE

- Twenty primes should be sufficient to move reagent to the ratio pump. However, if bubbles are still apparent in the ratio pump after 20 primes, again select Ratio Pump from the PRIME screen and request ten additional primes. Prime until all bubbles are removed from ratio pump.
- Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

4.25.2 "C" Cam Pinch Valve Adjustment

The "C" Cam Pinch Valve should not require frequent adjustment. However, if you should experience difficulty or a Beckman Technical Representative instructs you to adjust this part, perform the following procedure:

1. Press **SYS IDLE**. The screen will prompt: "Continue with the shut down procedure (Y/N)?"

   (a) Press **Y**, the **ENTER**. The screen will display:

   "SYSTEM IDLE" "CX3: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

   (e) Press **F4 RESUME**. The screen will prompt "This will reboot the system. Continue with the Resume procedure (Y/N)?"

   (f) Press **Y**, then **ENTER**. The message window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).

   (g) Press **PREV SCREEN**. A window will pop up giving four boot options.

   (h) Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."

   (i) Turn the PC console power OFF by using the switch on the front of the console unit.

   (j) Press MAIN power switch behind the right front panel of the lower compartment to OFF. Leave AUX power switch ON. The green power light will go out. Close compartment door.

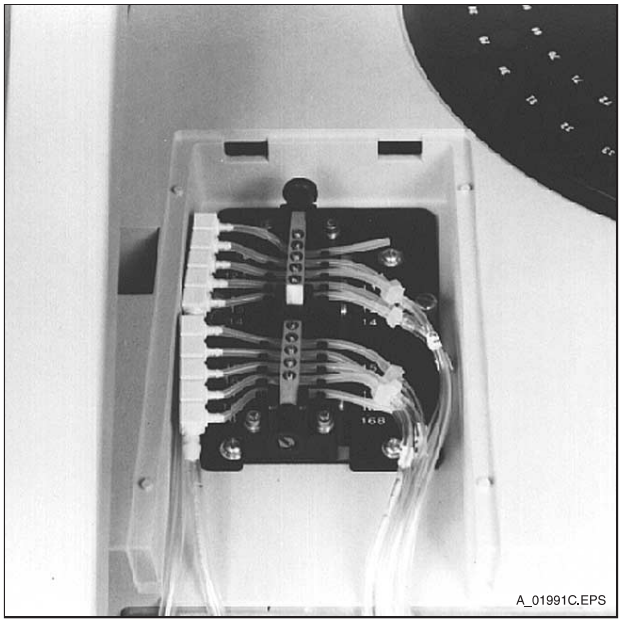


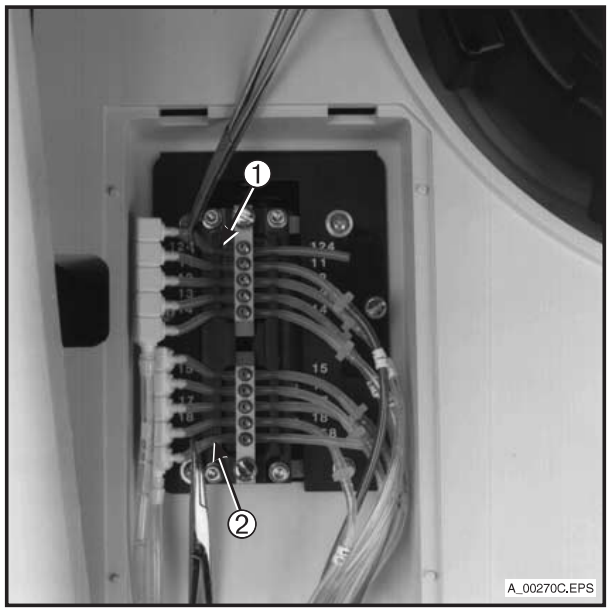
Figure 4-200. "C" Cam Pinch Valve Assembly

2. Before proceeding...

WARNING

To prevent electrical shock, disconnect system power cord from power source.

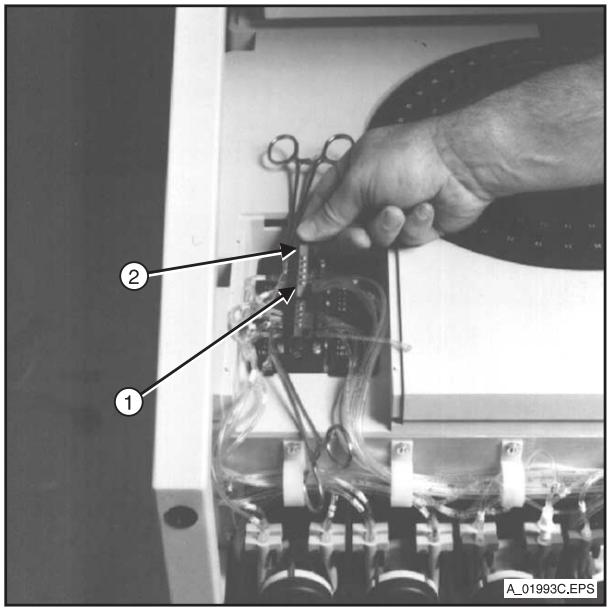
3. Using a hemostat, securely clamp lines 124 and 168 to prevent any reagent leakage (Figure 4-201).



1 - Line #124
2 - Line #168

Figure 4-201. Hemostat on Lines 124 and 168

4. Release pressure bars by loosening the screws and then lifting the pressure bars or, by pulling out and lifting up on the black release knob (Figure 4-202). Remove all the tubing (lines 11 through 18, 124, and 168) from the pinch valve assembly.



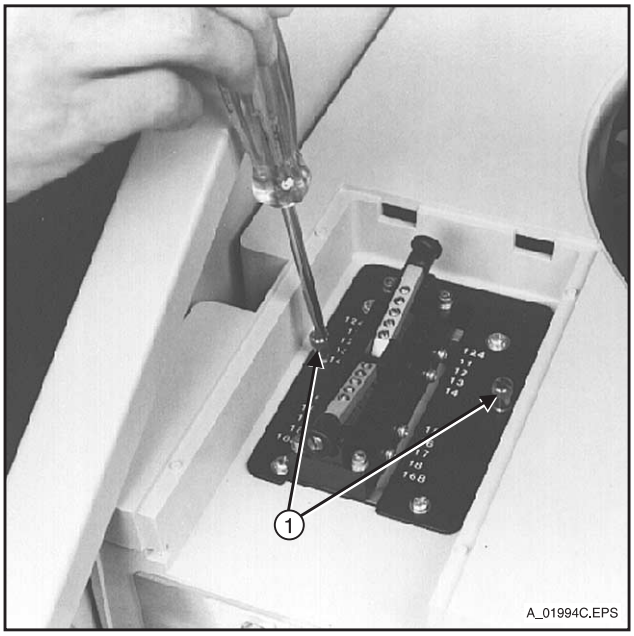
1 - Pressure Bar
2 - Release Knob

Figure 4-202. Opening/Closing Pressure Bar

5. Unscrew the two captive mounting screws (Figure 4-203).
6. While holding the tubing aside with one hand, grasp the pinch valve assembly and remove it from the mounting location.

NOTICE

When removing pinch valve, be careful not to catch any of the valve wiring on the sides of the valve housing as damage may occur to the wiring.

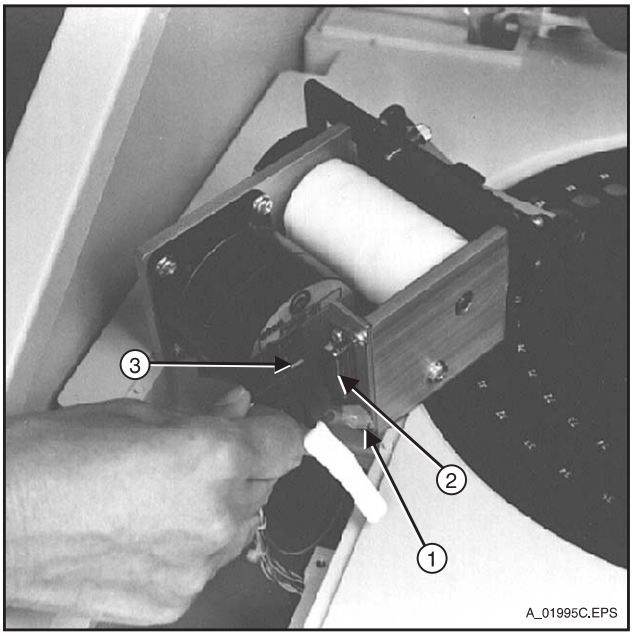


1 - Mounting Screws

Figure 4-203. Captive Mounting Screws

7. Disconnect socket from plug on back of pinch valve assembly (Figure 4-204).

8. Remove ground wire from valve by holding the plastic coated portion of the connector and pulling it away from the ground lug (Figure 4-204).



1 - Ground Wire
2 - Socket
3 - Plug

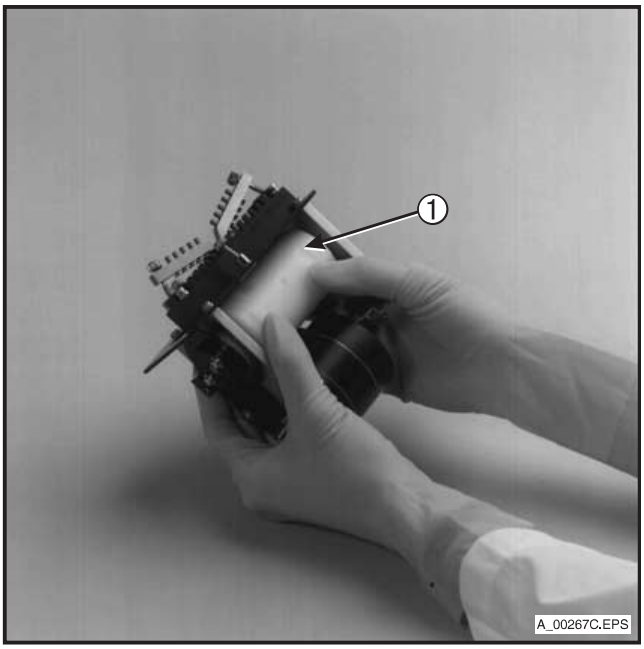
Figure 4-204. Removing/Replacing "C" Cam Pinch Valve Assembly

ADJUSTING LINE POSITIONS 124, 11, 12, 13, and 14

CAUTION

DO NOT rotate cam using black sensor disk.

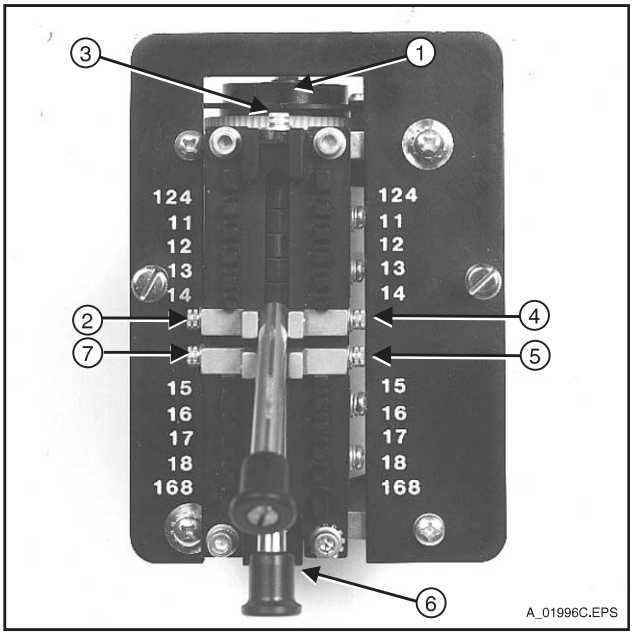
9. Manually rotate cam to position halfway between 2 and 3 (Figure 4-205).
10. Close pressure bars.



1 - Cam

Figure 4-205. Rotating the Cam

11. Loosen socket-head screws A, B, and C (Figure 4-206) one-half turn using 3/32-inch size socket-head wrench.



1 - Cam Position between 2 and 3
2 - Socket-Head Screw A
3 - Socket-Head Screw B
4 - Socket-Head Screw C
5 - Socket-Head Screw D
6 - Socket-Head Screw E (Not Shown)
7 - Socket-Head Screw F

Figure 4-206. Socket-Head Screws

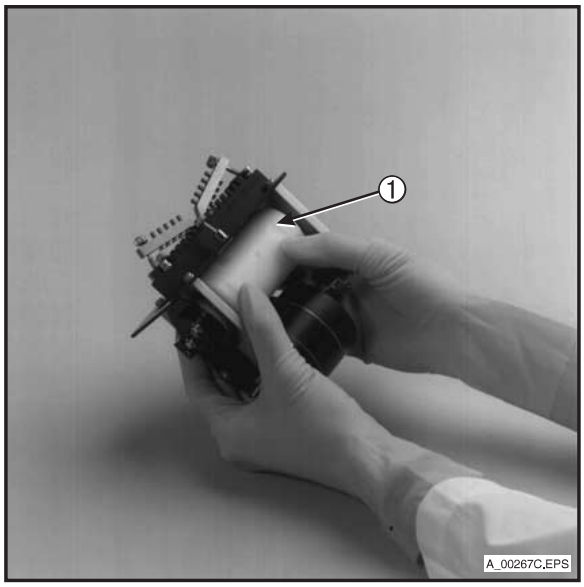
ADJUSTING LINE POSITIONS 124, 11, 12, 13, and 14

12. Manually rotate cam to position halfway between 2 and 3 (Figures 4-207 and 4-208).

13. Close pressure bar.

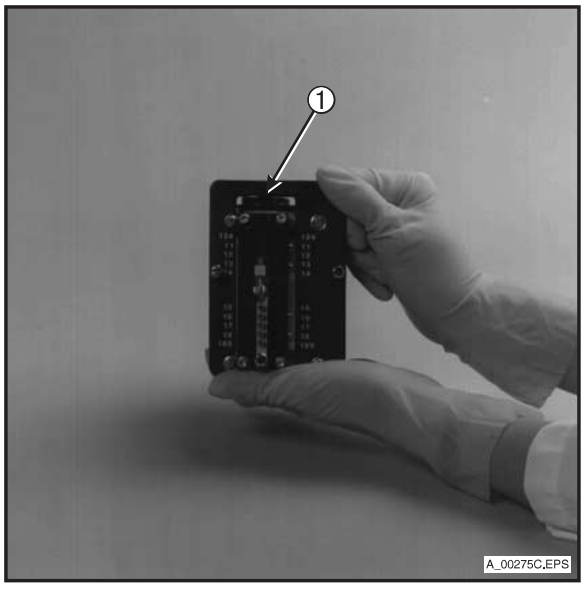
CAUTION

Do not forcibly insert or remove gauge as damage to cam plungers may result.



1 - Cam

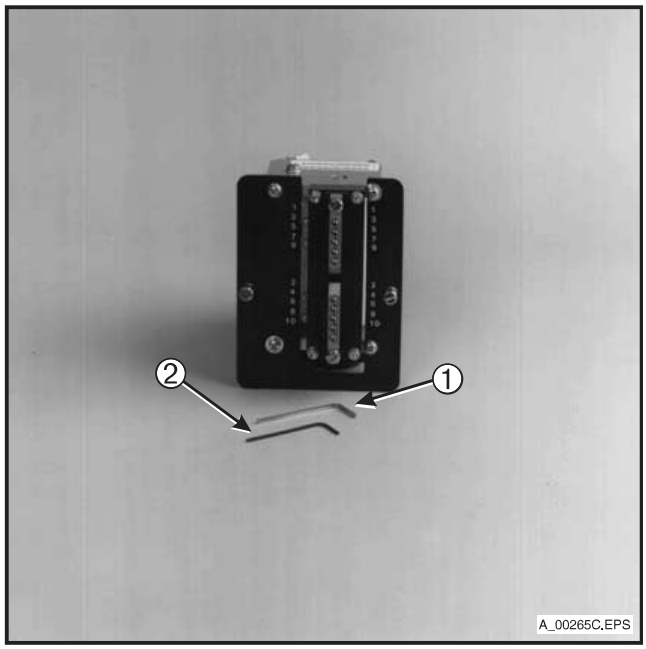
Figure 4-207. Rotating the Cam



1 - Cam Position Halfway between 2 and 3

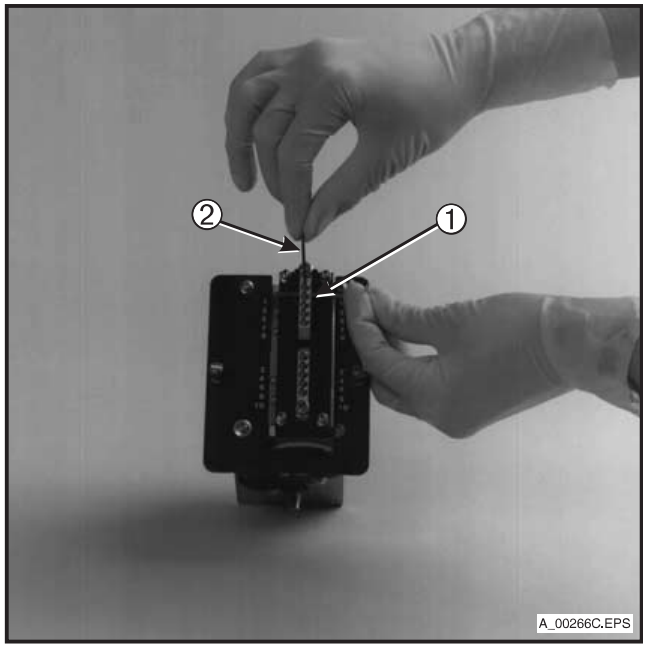
Figure 4-208. Setting Cam Position

14. Insert the adjustment gauge (PN 450968) individually into line positions 124, 11, 12, 13, 14 (Figure 4-209). Start with position 124; turn adjustment screw clockwise until it makes contact with the adjustment gauge (Figure 4-210). Gently slide gauge in and out. Slight resistance should be felt.



1 - Line Adjustment Gauge
2 - Line Adjustment Tool

Figure 4-209. Cam and Adjustment Tools



1 - Line Adjustment Screws
2 - Line Adjustment Tool

Figure 4-210. Tightening Line Adjustment Screws

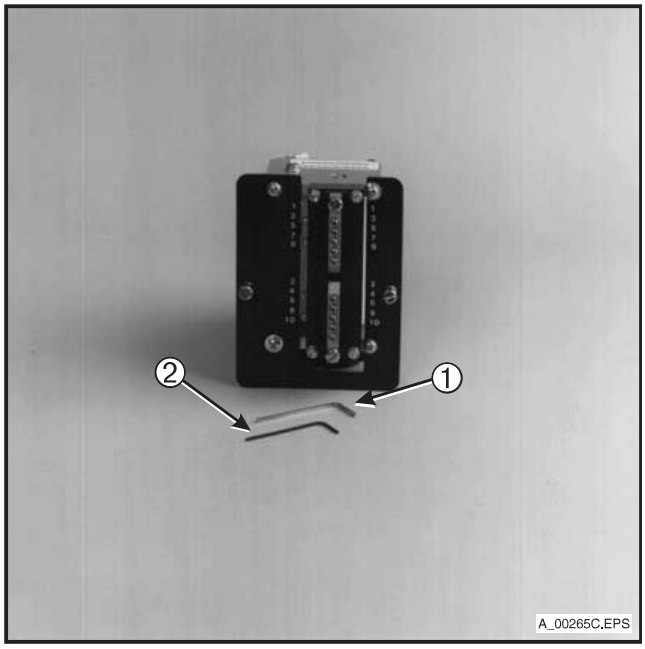
ADJUSTING LINE POSITIONS 15, 16, 17, 18, and 168

15. Verify cam is still positioned halfway between 2 and 3 and pressure bar is closed (Figure 4-208).

CAUTION

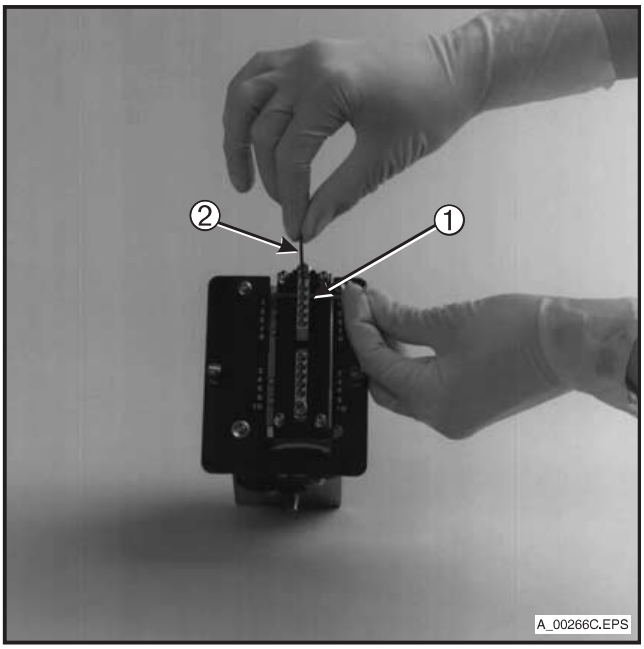
Do not forcibly insert or remove gauge as damage to cam plungers may result.

16. Insert the adjustment gauge (PN 450968) individually into line positions 15, 16, 17, 18, 168 (Figure 4-211). Start with position 15; turn adjustment screw clockwise until it makes contact with the adjustment gauge (Figure 4-212). Gently slide gauge in and out. Slight resistance should be felt.
17. Connect socket to plug on back of the "C" Cam pinch valve Assembly.
18. Attach the ground wire to ground lug.
19. While holding tubing aside with one hand, place pinch valve assembly into mounting position.
20. Tighten the two captive mounting screws.



1 - Line Adjustment Gauge
2 - Line Adjustment Tool

Figure 4-211. Cam and Adjustment Tools

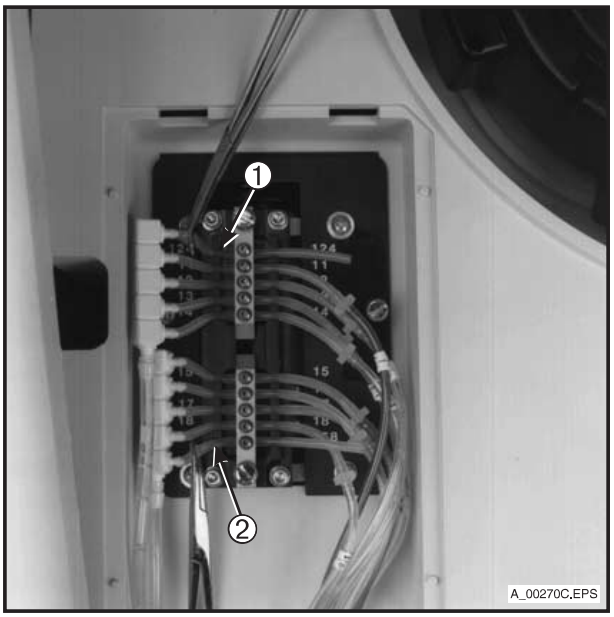


1 - Line Adjustment Screw
2 - Line Adjustment Tool

Figure 4-212. Tightening Line Adjustment Screw

21. Open pressure bars. Place reagent lines (11 through 18, 124, and 168) into their respective pinch valve slots (Figure 4-213).
22. Close pressure bars.
23. Remove hemostat from vent lines 124 and 168.
24. Reconnect system power cord to power source.
25. Press system Main power switch to the ON position and allow the system to reboot.
26. Turn the PC console power ON by using the switch on the front of the console unit.
27. Prime the Wash Solution, BUN3, GLU3, and CRE3 reagents three times. Program system as follows:
    (a) From the Special Function Screen, press **1**. PRIME. Cursor and select Wash Solution BUN3, GLU3, and CRE3.
    (b) Type the number of primes desired (3).

(c) The Prime Screen will then indicate the number of primes remaining. The prime cycles are completed when CX3 status displays Stand By.



1 - Line #124
2 - Line #168

Figure 4-213. Placing Reagent Lines into Pinch Valve Slots

28. Inspect the system for leaks during priming. Stop priming if any leaks are noticed and correct the problem.

29. Replace sliding cover over "C" Cam pinch valve assembly. Close peri-pump cover. Be careful not to pinch the tubing.

NOTICE

Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

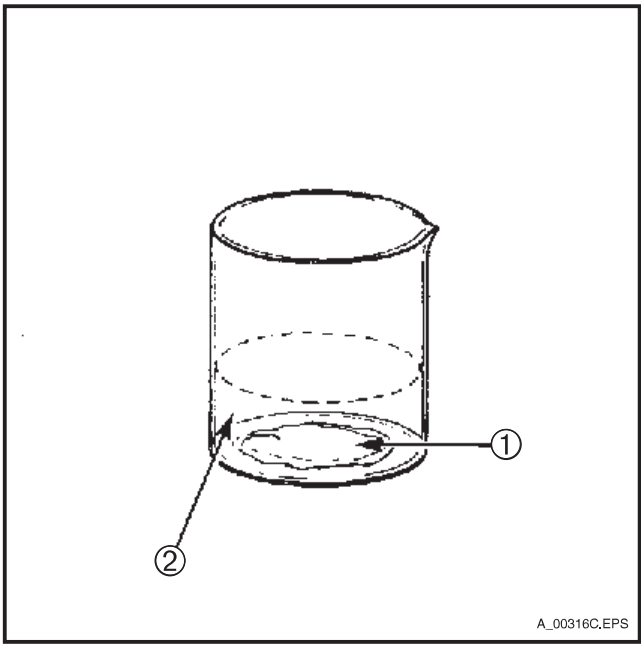
4.26 PREPARING SODIUM MEASURING OR SODIUM REFERENCE ELECTRODE FOR INSTALLATION

NOTICE

After completion of any parts replacement procedure, a successful calibration must be performed prior to operation of the system.

1. Prepare a 1:5 soaking solution using electrolyte reference and diluted electrolyte buffer reagents. This may be done by combining one part full strength electrolyte buffer with four parts deionized water. Mix well. Next, prepare a 1:20 soaking solution by combining one part electrolyte reference reagent and nineteen parts of diluted electrolyte buffer.

2. In a small beaker or glass container, prepare a soft bottom lining using crumpled multiple layers of Na/K-free filter paper (Figure 4-214). Saturate this lining to a depth not to exceed one-quarter inch (6 mm) with soaking solution (see Step 1 of this procedure).



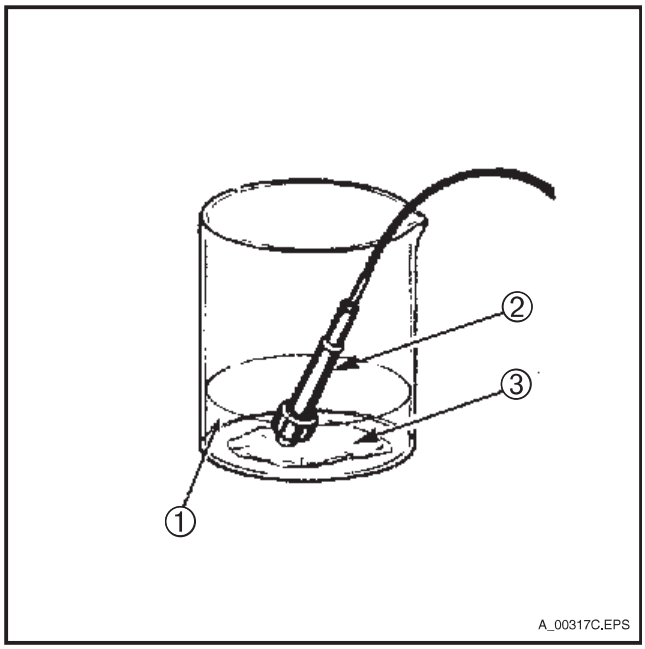
1 - Na/K-Free Filter Paper
2 - 1/4-Inch (6mm) Soaking Solution

Figure 4-214. Beaker with Soaking Solution

3. Unpack the electrode.

4. Very carefully remove the black protective cap covering the glass tip.

5. Suspend electrode in beaker so that only the tip is covered by soaking solution (Figure 4-215).



1 - Soaking Solution Level (Not to Exceed 1/4-Inch, 6 mm)
2 - Electrode
3 - Na/K-Free Filter Paper

Figure 4-215. Soaking the Sodium Measuring/ Reference Electrode Tip

6. For maximum operational stability, the electrode soaking time in soaking solution is 24 hours. The minimum required time is one hour.

NOTICE

If maximum soaking time is not allowed, the new electrode may require a few hours of operation to achieve complete electrical stability. During this period more frequent calibration than normal may be required in response to system error messages. Assay results will not be compromised during this time.

7. When ready to install the electrode, remove it from the soaking solution and dry only the sides using lintless tissue. DO NOT touch the electrode tip.

The following procedures apply to the ISE module only (CX5 users only).

4.27 ISE MODULE CIRCUIT BOARD REPLACEMENT

For instructions on circuit board removal and replacement, refer to Paragraph 4.4.

4.28 ELECTRODE REPLACEMENT

4.28.1 Carbon Dioxide Electrode Replacement

1. Remove reagent line #24A from the alkaline buffer reagent bottle.

NOTE

Do not remove the large return line from the alkaline buffer reagent bottle (Figure 4-216). Removing it could cause a reagent spill when the system is primed.

1 - Reagent return line
2 - Line #24A (alkaline buffer reagent line)

Figure 4-216. Alkaline Buffer Lines

2. Prime the alkaline buffer reagent 10 times to evacuate the lines. Program the system as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

(c) Cursor and **SELECT** Alkaline Buffer.

(d) Press **F1 START PRIME**.

(e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining.

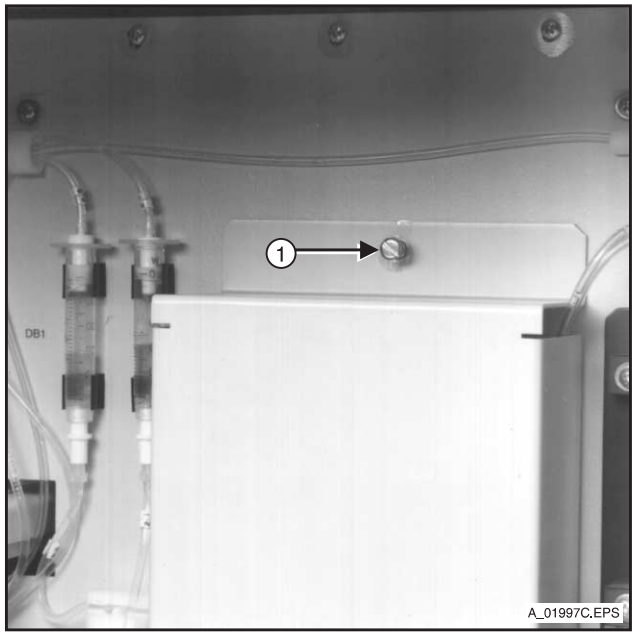
3. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS.**

   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.

   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.

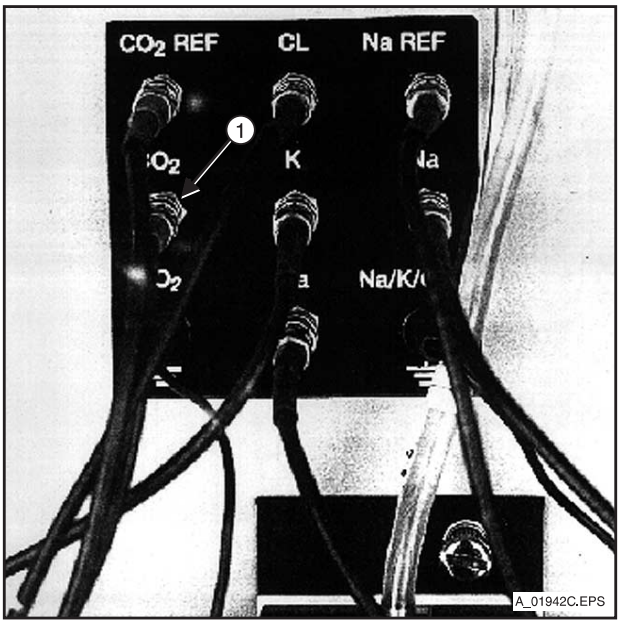
4. Remove the flow cell cover by first loosening the captive retaining screw located at the top of the cover (Figure 4-217). Grasp the cover and carefully lift up and out. Set cover aside.



1 - Captive Screw

Figure 4-217. Flow Cell Cover

5. Disconnect the CO_2 electrode cable (Figure 4-218).

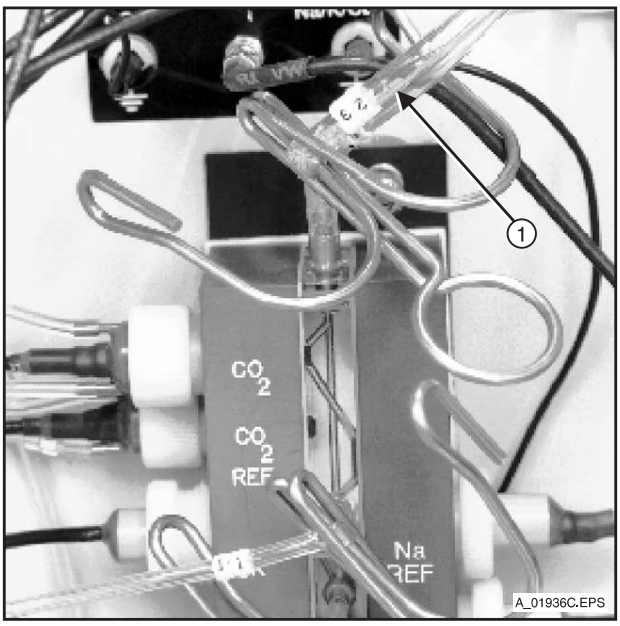


1 - CO_2 Electrode Cable

Figure 4-218. Disconnect CO_2 Electrode Cable.

6.

   (a) Using a hemostat, securely clamp the top front electrolyte drain tubing (line #23) approximately one inch (25 mm) from the top of the flow cell (Figure 4-219). This will prevent the backflow of reagent into the flow cell.



1 - Line #23

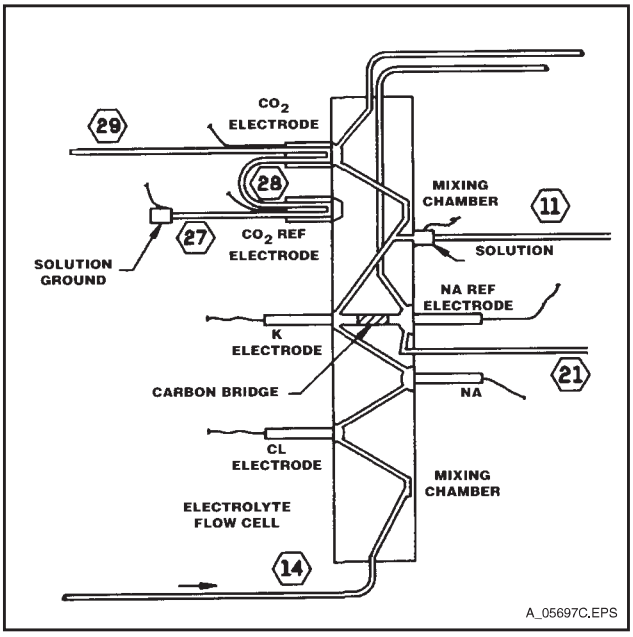
Figure 4-219. Flow Cell Assembly

(b) Using another clamp, clamp off the CO2 acid tubing (line #11) on the front of the flow cell as close to the connector as possible (Figure 4-219). This will prevent acid flow into the flow cell.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from the flow cell solenoid valve.

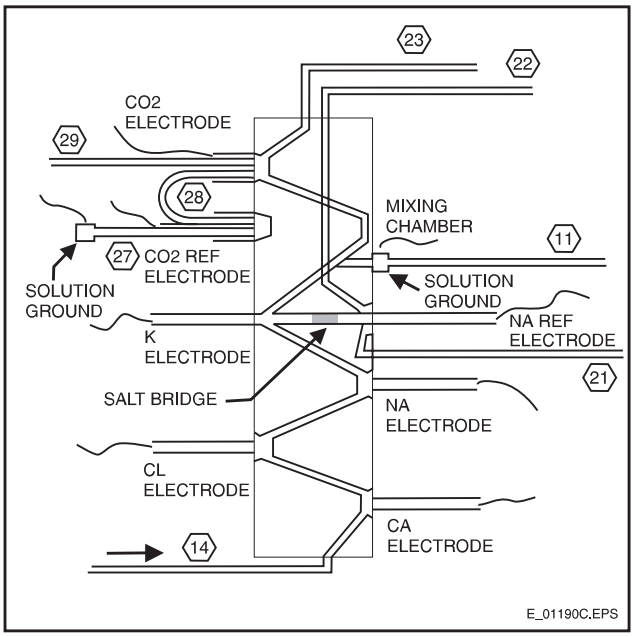
7. Locate the CO_2 electrode. Disconnect reagent lines labeled #28 and #29 from the electrode (Figure 4-220). Remove electrode by turning the electrode retainer nut counterclockwise.



A

Figure 4-220. CO_2 Electrode Placement on the Flow Cell (non CX5 DELTA system)

8. Remove the retainer nut from the old electrode.



B

Figure 4-220. CO_2 Electrode Placement on the Flow Cell (CX5 DELTA system)

9. Remove membrane as follows:

(a) Pry off the membrane retainer assembly.

(b) Remove the quad-ring from the retainer. Inspect the electrode port if the quad-ring is not on the electrode.

(c) Separate membrane retainer and membrane clamp (Figure 4-221). Discard used membrane.

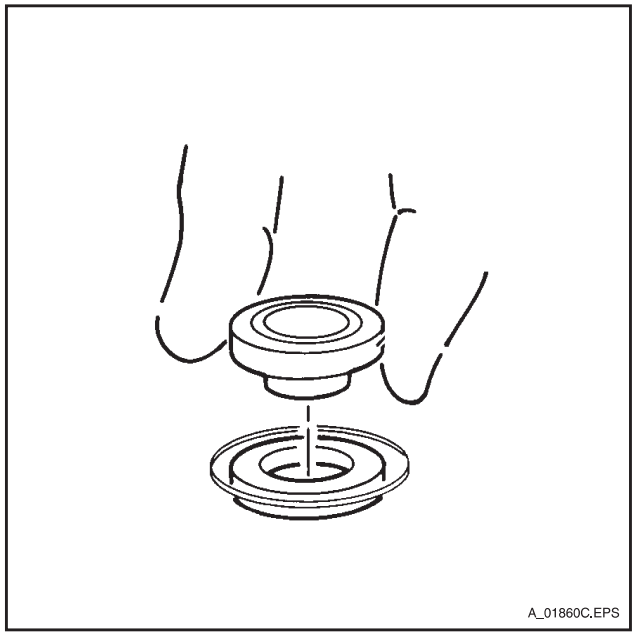


Figure 4-221. CO_2 Measuring Electrode.

10. With tweezers remove new membrane (Beckman P/N 661750) from package contained in the ISE Module Maintenance Kit. Rinse membrane thoroughly in deionized water to remove all traces of dry powder (Figure 4-222). Dry the membrane using lintless tissue. Discard excess paper membrane spacers.

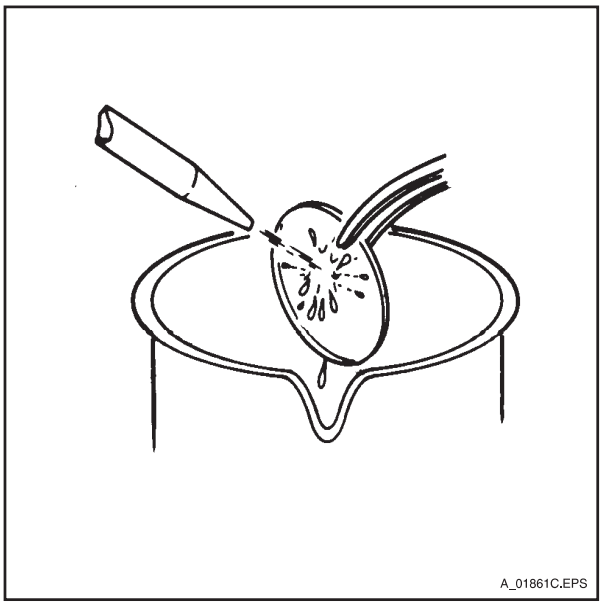
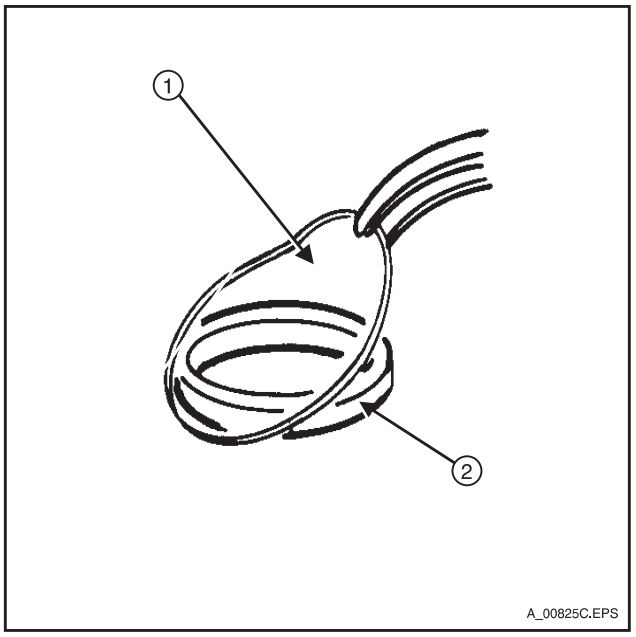


Figure 4-222. Rinsing the Membrane with Deionized Water.

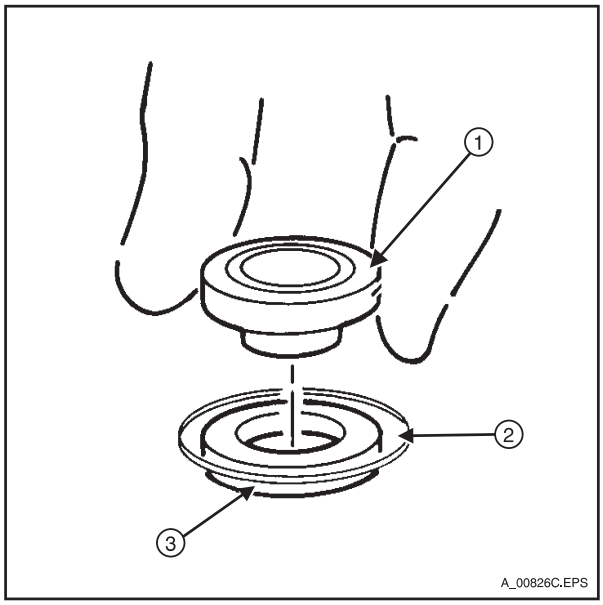
11. Place the membrane clamp on a flat surface. Using tweezers, carefully center the membrane on top of the membrane clamp (Figure 4-223).



1 - Membrane
2 - Clamp

Figure 4-223. CO_2 Membrane Placement.

12. Center the membrane retainer over the membrane clamp. Press the membrane retainer into the clamp, thus securing the membrane (Figure 4-224).



1 - Retainer
2 - Membrane
3 - Clamp

Figure 4-224. Securing the CO_2 Membrane.

13. Place the retainer assembly upside down on the work surface so the clamp is on top and retainer on bottom. Grasp the electrode carefully and press it firmly against the membrane and into the membrane clamp (Figure 4-225).

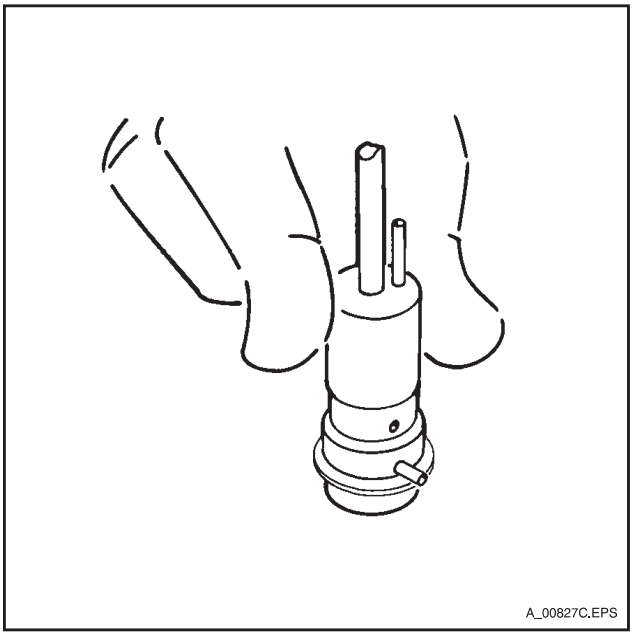


Figure 4-225. Securing the Membrane Retainer.

14. Inspect the membrane to verify that it is not torn, punctured or wrinkled and is centered properly. If membrane is not centered correctly or is damaged, repeat Steps 9 through 14.

15. Reinstall new quad-ring onto the membrane retainer (Figure 4-226). When installed, the quad-ring must be on the very end of the CO_2 electrode. This ensures a proper fluid seal when the electrode is installed in the flow cell.

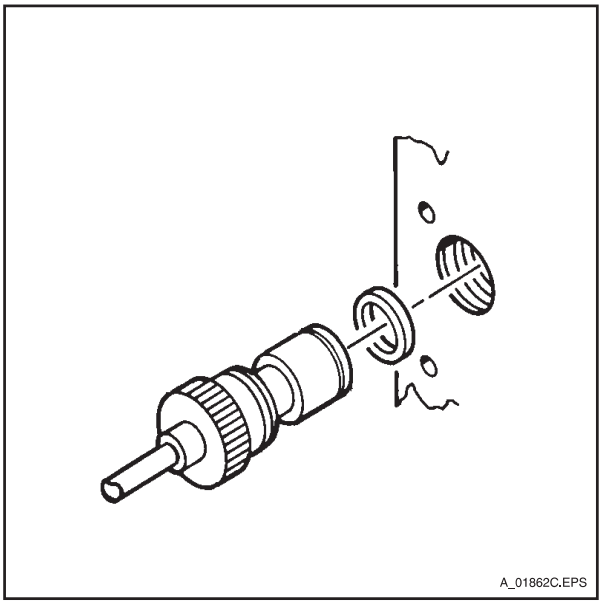


Figure 4-226. Reinstallation of Quad-Ring.

CAUTION

Do not touch membrane surface when installing the quad-ring as damage to the membrane may result.

16. Using a lint-free tissue, carefully dry the electrode assembly and electrode port to remove all traces of moisture.

NOTE

Electrode and electrode port must be completely dry before reinstalling electrode.

17. Insert the new CO_2 electrode into electrode port. Be careful to align key on electrode with keyway in the electrode port.
18. Insert retainer nut and turn clockwise until finger-tight.
19. To test for proper seating of electrode, gently pull on electrode body (Figure 4-227). The electrode assembly should not move. If the electrode moves, remove it and reinstall. Check for an extra or missing quad-ring if installation is difficult. Should you experience any difficulties,

call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

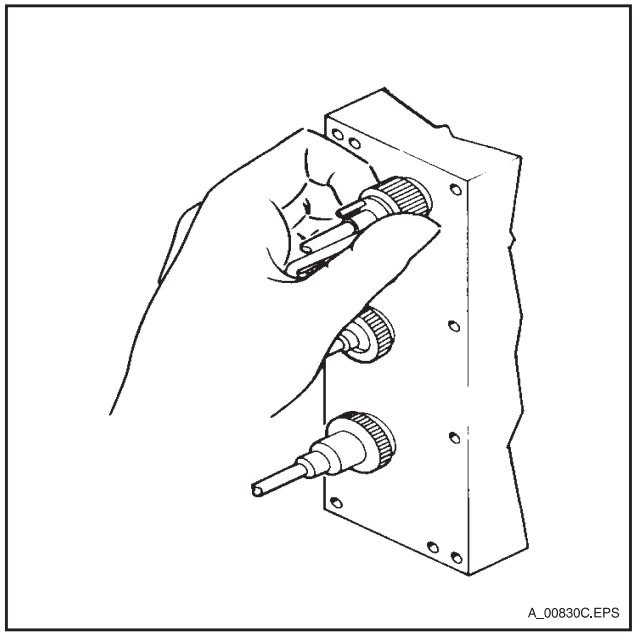
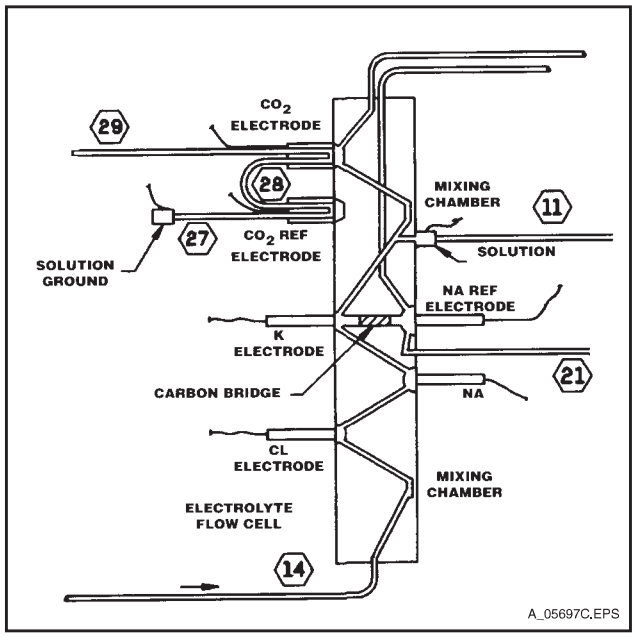
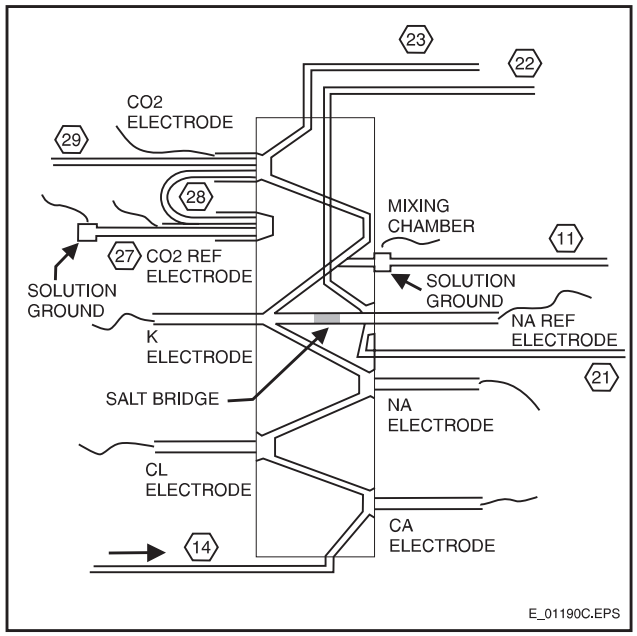


Figure 4-227. Testing for Proper Seating of CO_2 Electrode.

20. Reconnect tubing lines labeled #28 and #29 to the electrode (Figure 4-228).



A

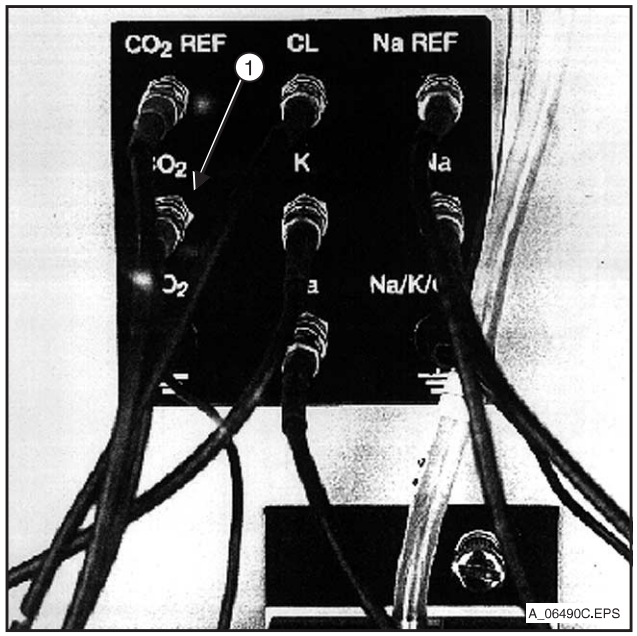


B

Figure 4-228. Reconnect Tubing to CO_2 Electrode (non CX5 DELTA system)

Figure 4-228. Reconnect Tubing to CO_2 Electrode (CX5 DELTA system)

21. Reconnect electrode cable to the appropriate connector (Figure 4-229).



1 - CO_2 Electrode Cable

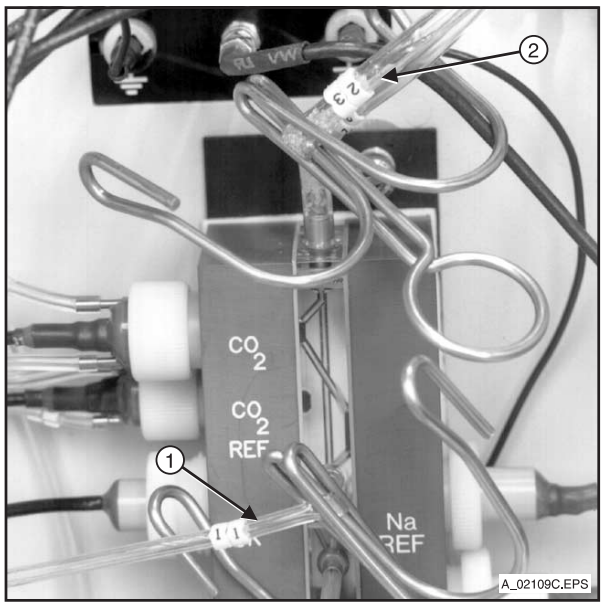
Figure 4-229. Reconnect Electrode Cable

22. Reconnect reagent line #24A to the alkaline buffer reagent bottle (Figure 4-230).

1 - Line #24A

Figure 4-230. Reconnect Reagent Line #24A

23. Remove hemostats from top front electrolyte drain and CO_2 acid tubing (Figure 4-231).



1 - Line #11
2 - Line #23

Figure 4-231. Remove Hemostats from Line #23 and Line #11

24. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.

25. Prime CO_2 alkaline buffer reagent 15 times. Program the system as follows:

    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

    (c) Cursor and **SELECT** Alkaline Buffer.

    (d) Press **F1 START PRIME**.

    (e) Operator is prompted to enter the number of prime cycles. Type **15** and press **ENTER**. The display indicates the number of primes remaining. While system is priming observe flow cell for leaks. Stop priming if any leaks are noticed and correct problem.

26. Reinstall the flow cell cover taking care not to pinch the tubing.

4.28.2 Carbon Dioxide Reference Electrode Replacement

1. Remove reagent line labeled #24A from the alkaline buffer reagent bottle (Figure 4-232).

NOTE

Do not remove the large return line from the alkaline buffer reagent bottle (Figure 4-232). Removing it could cause a reagent spill when the system is primed.

1 - Line #24A (alkaline buffer reagent line)
2 - Reagent return line

Figure 4-232. Remove Reagent Line from Alkaline Buffer

2. Prime the alkaline buffer reagent 10 times to evacuate the lines. Program the system as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

   (c) Cursor and **SELECT** Alkaline Buffer.

   (d) Press **F1 START PRIME**.

   (e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining.

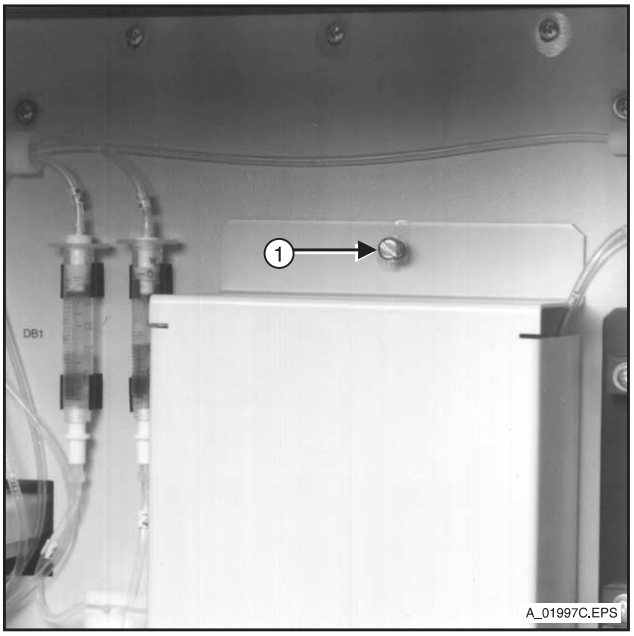
3. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:

   (a) From the MASTER SCREEN, press **F4 SPECIAL FUNCTIONS**.

   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.

   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.

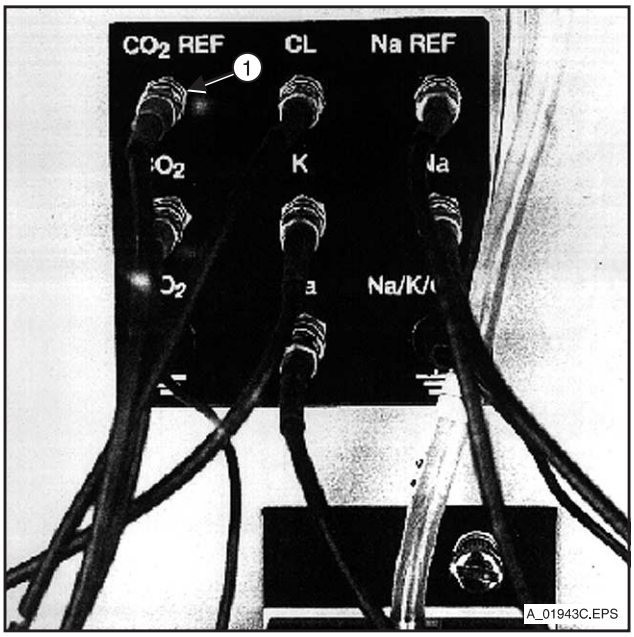
4. Remove the flow cell cover by first loosening the captive retaining screw (Figure 4-233). Grasp the cover and carefully lift up and over the two guide screws. Set cover aside.



1 - Captive Screw

Figure 4-233. Flow Cell Cover

5. Disconnect the CO_2 reference electrode cable (Figure 4-234).



1 - CO_2 Reference Electrode Cable

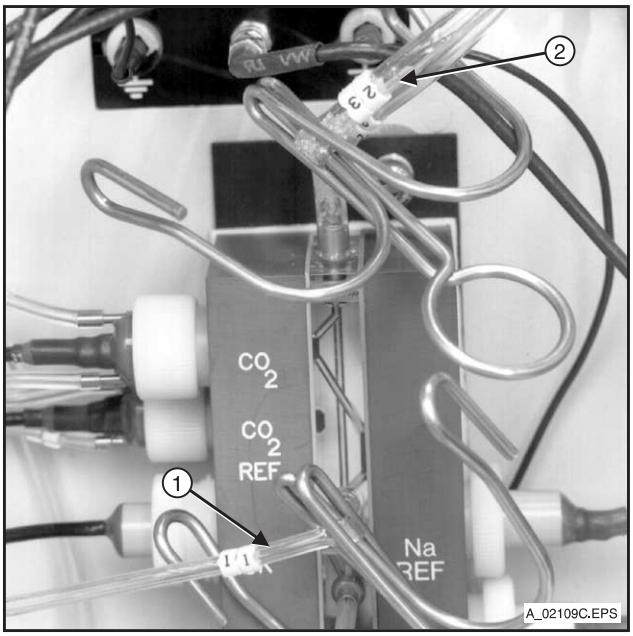
Figure 4-234. Disconnect CO_2 Reference Electrode Cable.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from the flow cell solenoid valve.

6.

   (a) Using a hemostat, securely clamp the top front electrolyte drain tubing (line #23) approximately one inch (25 mm) from the top of the flow cell (Figure 4-235). This will prevent the backflow of reagent into the flow cell.



1 - Line #11
2 - Line #23

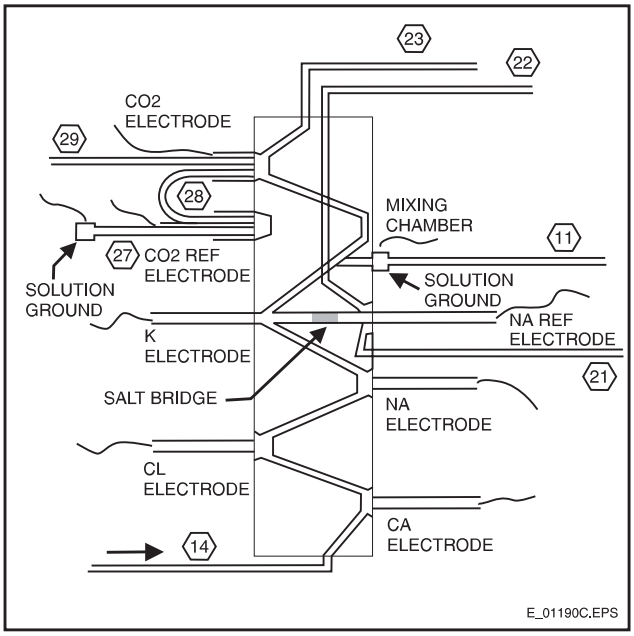
Figure 4-235. Hemostat on Drain Tubings (Line #23) and (Line #11)

(b) Using another clamp, clamp off the CO2 acid tubing (line #11) on the front of the flow cell as close to the connector as possible (Figure 4-235). This will prevent acid flow into the flow cell.

NOTE

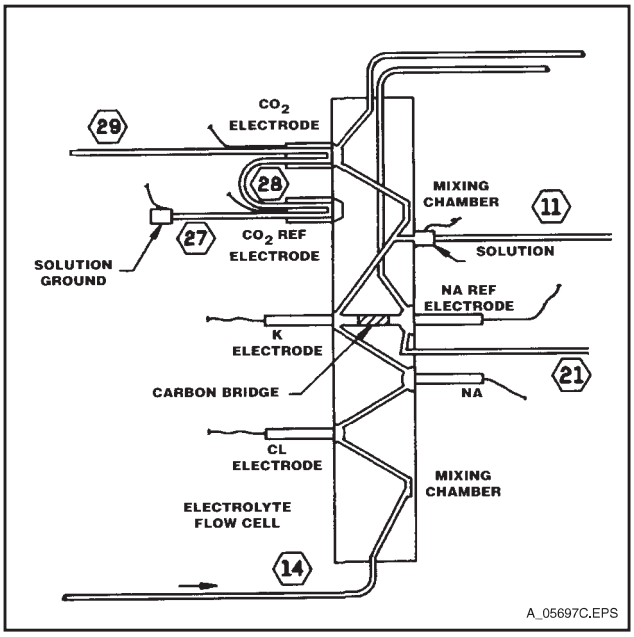
Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from the flow cell solenoid valve.

7. Locate the CO_2 reference electrode. Remove reagent lines labeled #27 and #28 from the electrode (Figure 4-236). Remove electrode by turning the retainer nut counterclockwise.



A

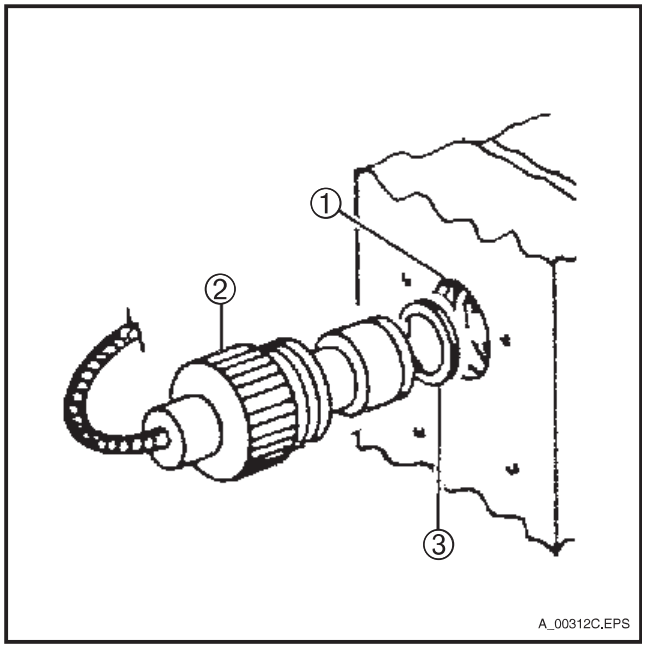
Figure 4-236. Electrode Placement on the Flow Cell (CX5 DELTA system)



B

Figure 4-236. Electrode Placement on the Flow Cell (non CX5 DELTA system)

8. Remove quad-ring and quad-ring retainer (Figure 4-237). Inspect electrode port if the quad-ring is not on the electrode tip. Remove the retainer nut from the old electrode.



1 - Electrode Port
2 - Retainer Nut
3 - Quad-Ring

Figure 4-237. Remove Quad-Ring

9. Using a lint-free tissue, dry the electrode assembly and electrode port to remove all traces of moisture.

NOTE

Electrode and electrode port must be completely dry before reinstalling electrode.

10. Install quad-ring and quad-ring retainer onto the new CO_2 reference electrode. When installed, the quad-ring must be on the very end of the CO_2 reference electrode. This ensures a proper fluid seal when the electrode is installed in the flow cell.

NOTE

The CO_2 reference electrode does not have a membrane.

11. Insert the new CO_2 reference electrode into the electrode port. Be careful to align key on electrode with keyway in the electrode port.
12. Turn the electrode retainer nut clockwise until finger-tight.
13. To test for proper seating of electrode, gently pull on electrode body (Figure 4-238). The electrode assembly should not move. If the electrode moves, remove it and try to reinstall. Check for an extra or missing quad-ring if installation is difficult. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

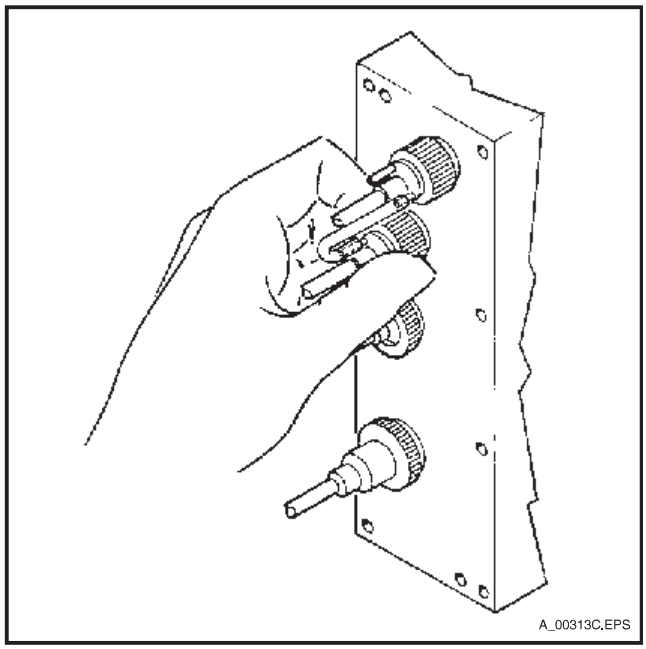


Figure 4-238. Testing for Proper Seating of CO_2 Reference Electrode

14. Reconnect tubing lines labeled #27 and #28 to the electrode (refer to Figure 4-236).
15. Reconnect electrode cable to the appropriate connector (refer to Figure 4-234).
16. Reconnect reagent line #24A to alkaline buffer reagent bottle (refer to Figure 4-232).
17. Remove hemostats from top front electrolyte drain and CO_2 acid tubing (refer to Figure 4-235).
18. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
19. Prime CO_2 Alkaline peri-pump 10 times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**
    (c) Cursor and **SELECT** Alkaline Buffer.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining. While system is priming observe flow cell for leaks. Stop priming if any leaks are noticed and correct problem.
20. Reinstall the flow cell cover taking care not to pinch the tubing.

4.28.3 Chloride Electrode Replacement

For instructions on chloride electrode removal and replacement, refer to the appropriate Operating Instructions.

4.28.4 Potassium Electrode Body or Electrode Tip Replacement

For instructions on potassium electrode body or electrode tip replacement, refer to the appropriate Operating Instructions.

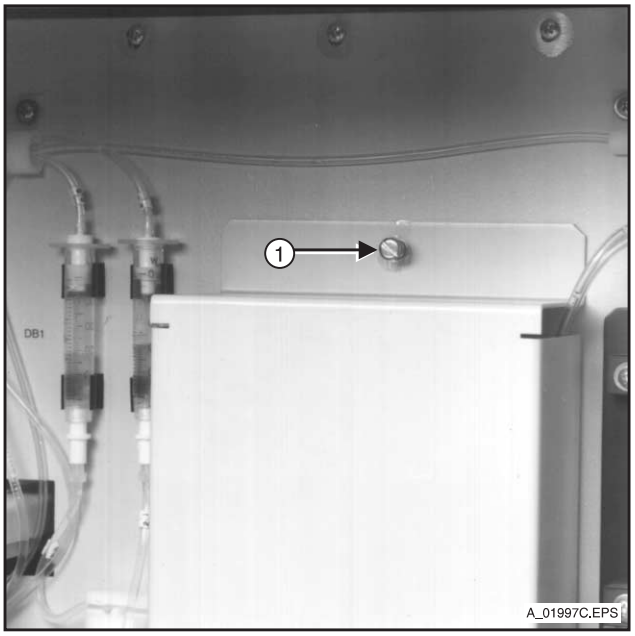
4.28.5 Calcium Electrode Body or Electrode Tip Replacement

For instructions on calcium electrode body or electrode tip replacement, refer to the appropriate Operating Instructions.

4.28.6 Sodium Electrode Replacement

The sodium electrode must soak for a minimum of one (1) hour before installation. For instructions on preparing sodium measuring and reference electrode before installation, refer to paragraph 4.26.

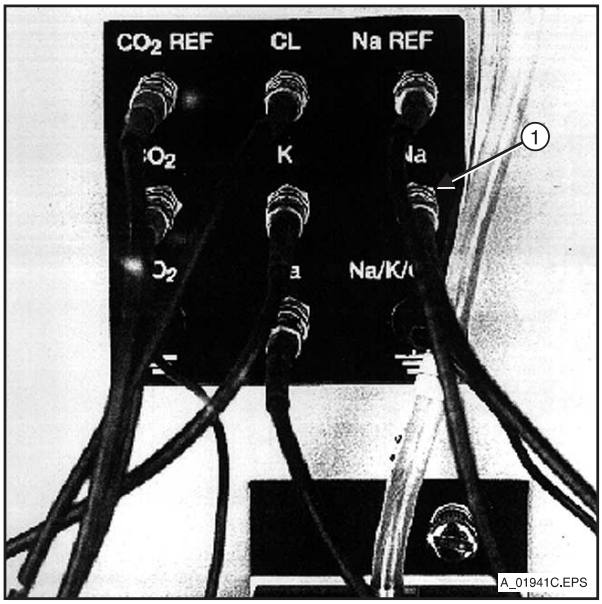
1. Assure that the system is in STANDBY, then
   (a) From the MASTER SCREEN, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.
2. Swing the crane arm to the right, away from the flow cell cover.
3. Remove the flow cell cover by removing the captive screw located at the top of the flow cell cover (Figure 4-239). Grasp the cover and carefully lift up and out. Set cover aside.



1 - Captive Screw

Figure 4-239. Flow Cell Cover

4. Disconnect sodium electrode cable (Figure 4-240).

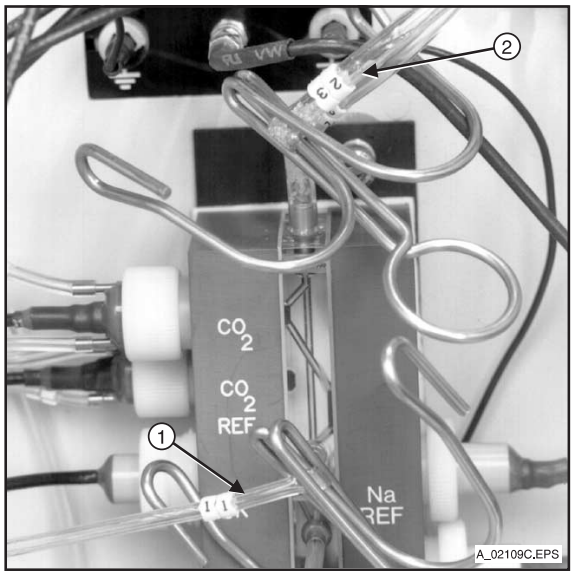


1 - Sodium Electrode Cable

Figure 4-240. Disconnect Sodium Electrode Cable

5.

(a) Using a hemostat, securely clamp the front piece (line #23) of electrolyte drain tubing approximately one inch (25 mm) from the top of the flow cell (Figure 4-241). This will prevent the backflow of reagent into the flow cell.



1 - Line #11
2 - Line #23

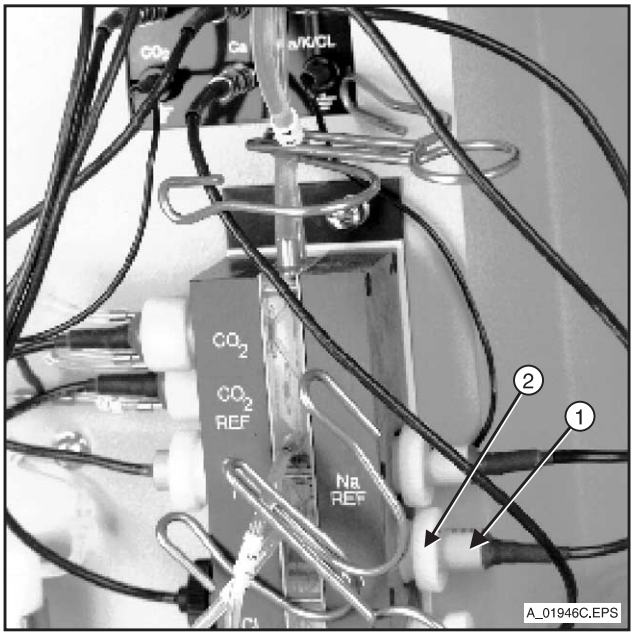
Figure 4-241. Clamps on Drain Tubings (Line #23) and (Line #11)

(b) Using another clamp, clamp off the CO2 acid tubing (line #11) on the front of the flow cell as close to the connector as possible (Figure 4-241). This will prevent acid flow into the flow cell.

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from flow cell solenoid valve.

6. Locate sodium electrode (Figure 4-242). Remove electrode by turning the electrode retainer nut counterclockwise. Inspect the electrode port if the quad-ring seal is not on the end of the electrode. Remove retainer nut and save for re-use on new electrode. Discard old electrode.



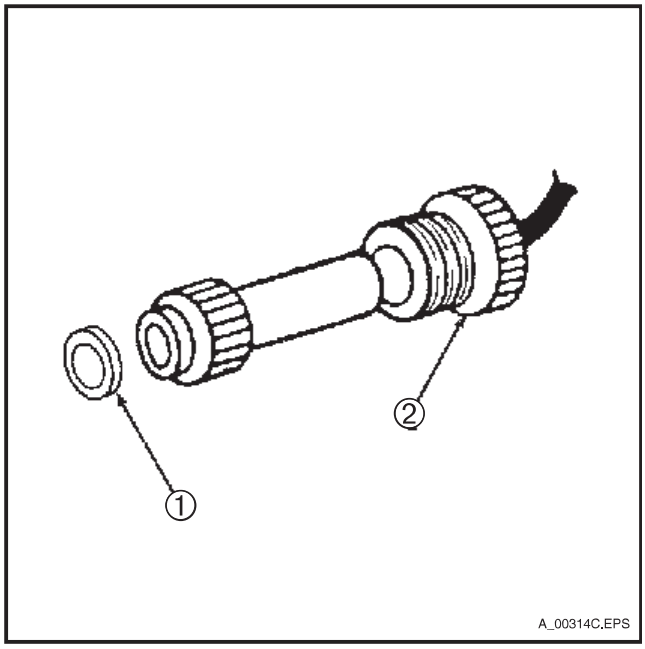
1 - Sodium Electrode
2 - Retainer Nut

Figure 4-242. Remove Sodium Electrode

7. Place the retainer nut on the PRESOAKED sodium electrode.

8. Examine the electrode tip. If an air bubble is seen inside the tip, hold the electrode cable near the end and spin the electrode for a few seconds. The bubble should be pushed back inside the electrode and remain there away from the tip.

9. Install a new quad-ring on the electrode (Figure 4-243). Thoroughly clean the electrode port with distilled water and dry with lintless tissue.



1 - Quad-ring
2 - Retaining Nut

Figure 4-243. Replace Quad-Ring

CAUTION

Do not pack tissue into the port or damage may occur to the flow cell internal wire.

10. Insert new electrode into electrode port and turn retainer nut clockwise until finger-tight.
11. To test for proper seating of electrode, gently pull on electrode body (Figure 4-244). The electrode assembly should not move. If the electrode moves, remove it and reinstall. If installation is difficult, check for an extra or missing quad-ring. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

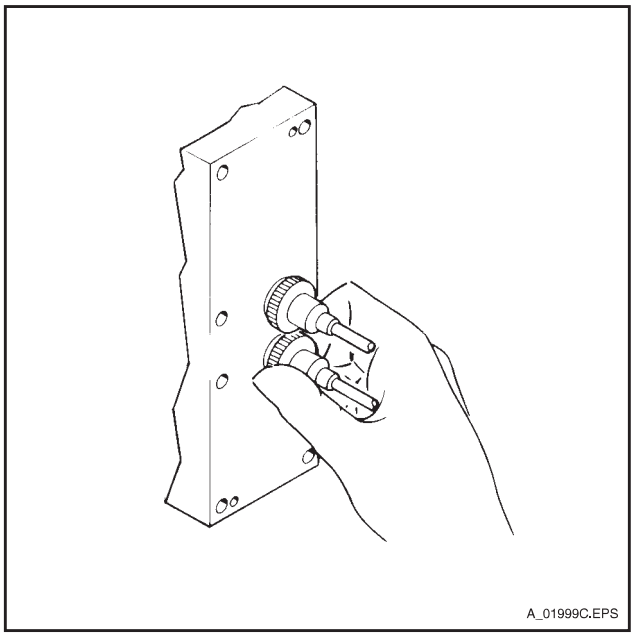


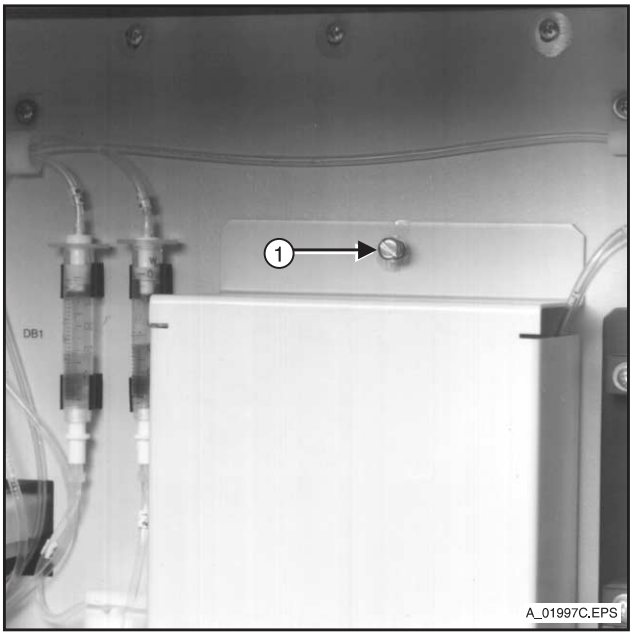
Figure 4-244. Testing for Proper Seating of Sodium Electrode

12. Reconnect electrode cable to the appropriate connector.
13. Remove clamps from front electrolyte drain and CO_2 acid tubings.
14. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
15. Prime the electrolyte buffer and CO_2 acid reagents five times by running “Ratio Pump” prime. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Ratio Pump.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **5** and press **ENTER**. The display indicates the number of primes remaining.

    Check for leaks. If any are noted, stop priming and repair. Remember to pinch off the front drain tubing if the sodium electrode is removed.
16. Reinstall the flow cell cover taking care not to pinch tubing.

4.28.7 Sodium Reference Electrode Replacement

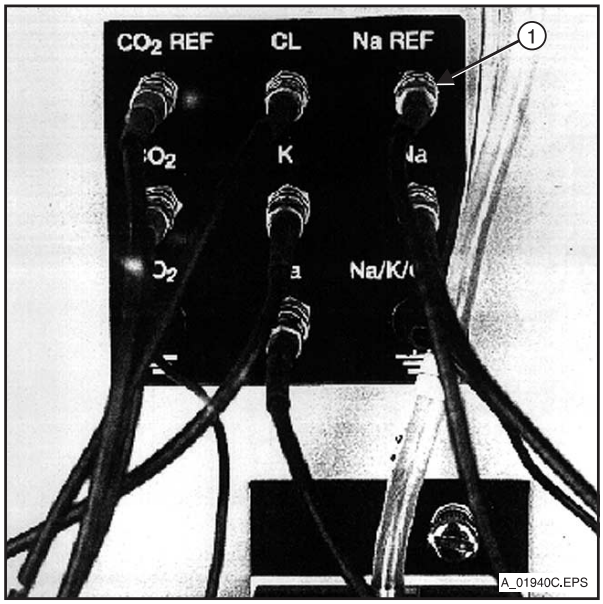
1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.
2. Swing the crane arm to the right, away from the flow cell cover.
3. Remove the flow cell cover by removing the retaining screw located at the bottom of the flow cell cover (Figure 4-245). Grasp the cover and carefully lift up and over the two remaining guide screws. Set cover aside.



1 - Captive Screw

Figure 4-245. Flow Cell Cover

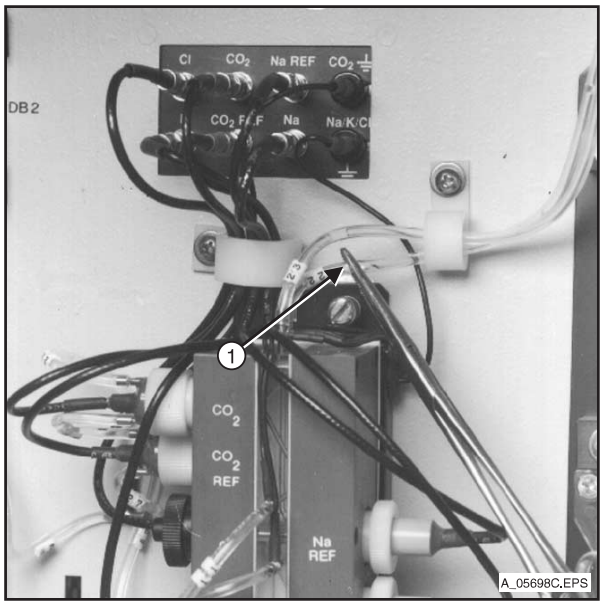
4. Disconnect sodium reference electrode cable (Figure 4-246).



1 - Sodium Reference Electrode

Figure 4-246. Disconnect Sodium Reference Electrode Cable

5.
   (a) Using a clamp, securely clamp the top rear electrolyte drain tubing (line #22) approximately one inch (25 mm) from the top of the flow cell (Figure 4-247). This will prevent the backflow of reagent into the flow cell.



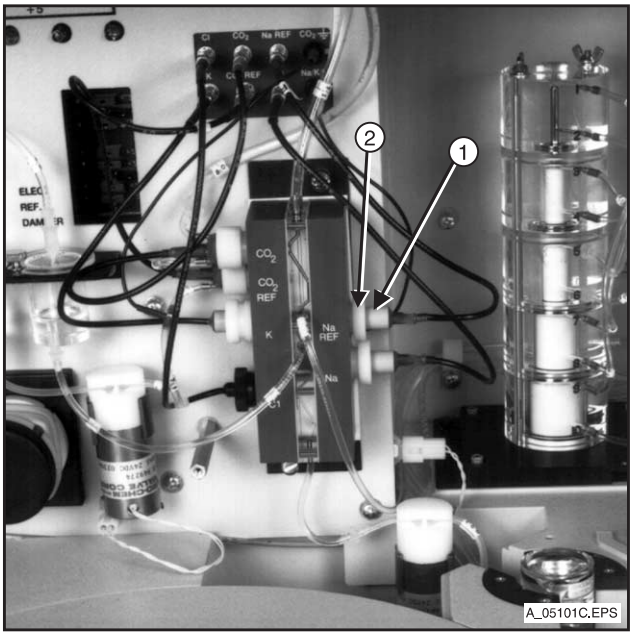
1 - Line #22

Figure 4-247. Hemostat on Drain Tubing (Line #22)

NOTE

Do not disconnect any of the reagent lines attached to the flow cell or remove tubing from flow cell solenoid valve.

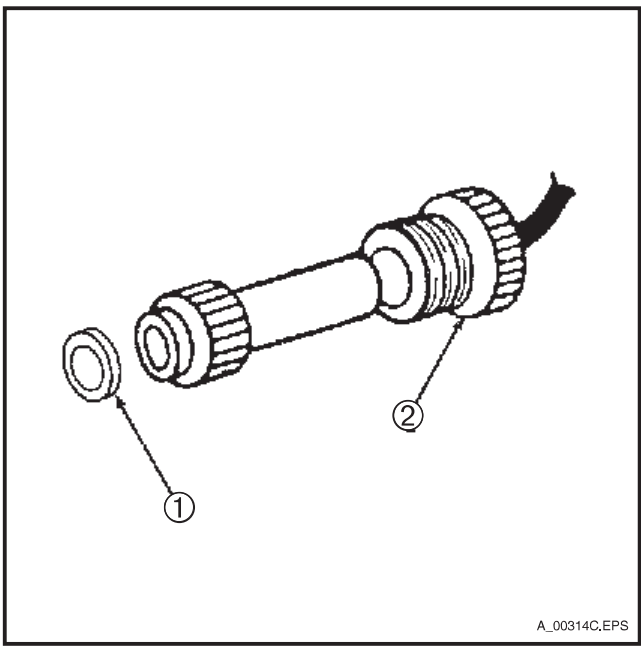
6. Locate the sodium reference electrode (Figure 4-248). Remove electrode by turning the electrode retainer nut counterclockwise. Inspect the electrode port if the quad-ring seal is not on the end of the electrode.



1 - Sodium Reference Electrode
2 - Retainer Nut

Figure 4-248. Remove Sodium Reference Electrode

7. Remove the retainer nut from the old electrode (Figure 4-249). Save retainer nut for re-use. Discard the old electrode.



1 - Quad Ring
2 - Retaining Nut

Figure 4-249. Remove Retainer Nut from Electrode

8. Place the retainer on the PRESOAKED sodium reference electrode.
9. Examine the electrode tip. If an air bubble is seen inside the tip, hold the electrode cable near the end and spin the electrode for a few seconds. The bubble should be pushed back inside the electrode and remain there away from the tip.
10. Install a new quad-ring on electrode (refer to Figure 4-249). Thoroughly clean the electrode port with distilled water and dry with a lint-free tissue.
11. Insert electrode into electrode port and turn retainer nut clockwise until finger-tight.
12. To test for proper seating of electrode, gently pull on electrode body (Figure 4-250). The electrode assembly should not move. If the electrode moves, remove it and reinstall. If installation is difficult, check for an extra or missing quad-ring. Should you experience any difficulties, call the Clinical Support Center (1-800-854-3633) or your local Beckman representative (refer to Appendix A).

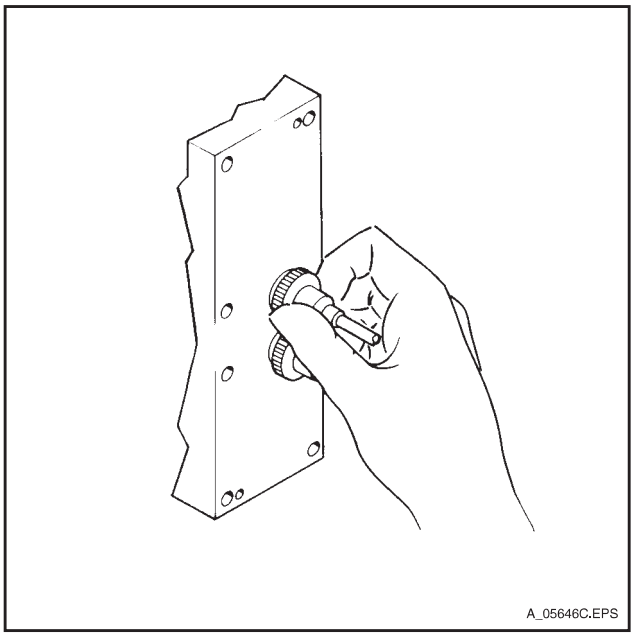


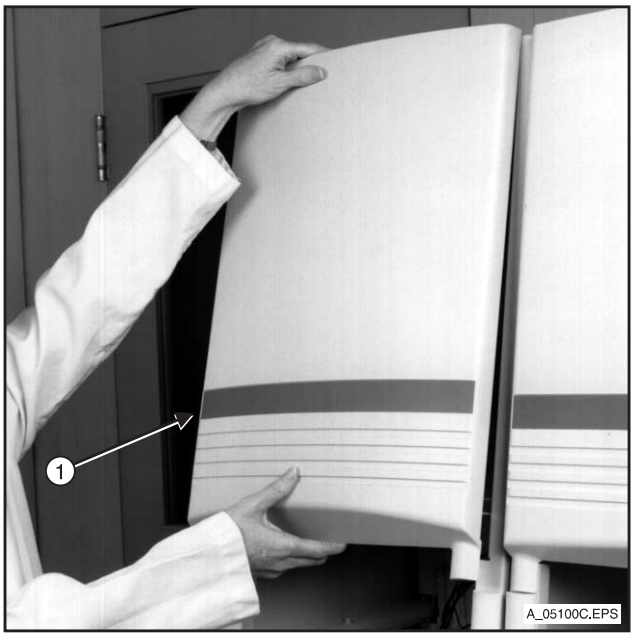
Figure 4-250. Testing for Proper Seating of Sodium Reference Electrode

13. Reconnect electrode cable to the appropriate connector.
14. Remove hemostat from rear electrolyte drain tubing.
15. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
16. Prime the electrolyte reference reagent five times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Electrolyte Reference Flow Cell.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **5** and press **ENTER**. The display indicates the number of primes remaining.

    Check for leaks. If any are noted, stop priming and repair. Remember to pinch off the rear drain tubing if the sodium reference electrode is removed.
17. Reinstall flow cell cover taking care not to pinch tubing.

4.29 ISE MODULE COMPARTMENT LAMP REPLACEMENT

1. Remove the ISE Module Circuit-board compartment cover.
    (a) Hold the top of the cover with one hand while pulling out from the bottom. Continue pulling from the bottom until bottom latch is free (Figure 4-251).



1 - Pull Out From Bottom

Figure 4-251. Removing ISE Module Compartment Cover

NOTE

This cover is not hinged. It comes completely off the instrument.

    (b) After bottom latch is free, lift cover up and remove. Set cover aside.
    (c) Remove metal card-cage cover. (Refer to Paragraph 4.4)
2. Locate the ISE Module compartment lamp mounted directly above the electrolyte injection cup. This is not a threaded bulb, it has a spring-loaded connection.
3. To remove the defective lamp, first push it into the socket (to the right) and then twist counterclockwise one quarter turn. The lamp should then pull out of the socket.
4. To install new lamp, line up the pins on the lamp base with the slots in the socket. The lamp is not polarized. Any pin can go into any slot.

5. Insert the lamp into the socket until resistance is felt. Continue to push lamp into socket against the spring contacts. While pushing in against the spring, gently turn the lamp clockwise until the lamp pins slip into the cutouts at the end of the socket slots. This will lock the lamp in place.
6. Gently pull out on lamp to ensure it is locked in place.
7. Turn the lamp on to verify that is now lights.
8. Reinstall the ISE Module card-cage cover and circuit-board compartment cover.
   (a) Replace card-cage cover. Tighten the 10 Phillips screws.
   (b) Grasp compartment cover at top and bottom
   (c) Engage top edge of cover in mounting channel. Ensure top and left side of cover are even with instrument.
   (d) Hold top of cover in place while pushing in on bottom to engage cover latch.

4.30 DEBUBBLER ASSEMBLY REMOVAL AND REPLACEMENT

The debubbler assemblies regulate the flow pressure of the alkaline buffer and electrolyte reference reagent to the CO_2 electrodes and the sodium reference electrode.

4.30.1 CO_2 Alkaline Buffer Debubbler

1. Remove reagent line #24A from the alkaline buffer reagent bottle (Figure 4-252).

1 - Line #24A
2 - Reagent Return LIne

Figure 4-252. Remove Reagent Line from Alkaline Buffer

NOTE

Do not remove the large drain line from the alkaline buffer reagent bottle. This line returns alkaline buffer reagent to the bottle. Removing it could cause a reagent spill when the system is primed.

2. Prime the alkaline reagent ten times to empty debubbler and lines. Program the system as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** CO_2 ALkaline Buffer.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type **10** and press **ENTER**. The display indicates the number of primes remaining.

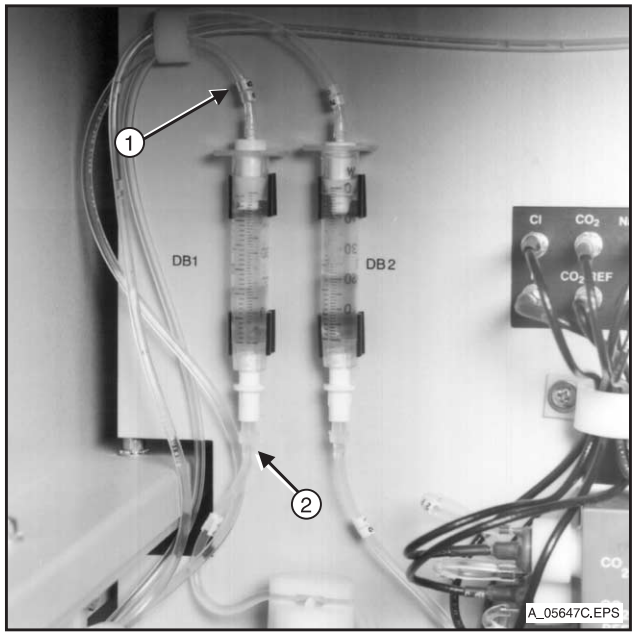
3. After priming is complete, assure the system is in STANDBY, then prevent the system from autopriming as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

   (b) Cursor and **SELECT** 6. Prime or type **6** and **ENTER**.

   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.

4. Ensure debubbler is empty. Remove input line #25 from top of debubbler and output line #26 from bottom of debubbler (Figure 4-253), by firmly grasping debubbler with one hand, pull lines off using a twisting motion with other hand.



1 - Line #25
2 - Line #26

Figure 4-253. Remove Input and Output Lines from Debubbler

5. Remove debubbler from mounting brackets and discard (Figure 4-253).

6. Install new debubbler assembly with volume numbers upside down in mounting brackets.

7. Connect input line #25 to top and output line #26 to bottom of debubbler.

8. Connect reagent line #24A to alkaline buffer reagent bottle.

9. Press **PREV SCREEN** to conclude this procedure. Allow system to reinitialize. Press **MASTER SCREEN**.

10. Prime the alkaline buffer reagent 10 times. While the system is priming, check for leaks. Stop the priming if any leaks are noticed and correct the problem.

11. If debubbler assembly is not one-half full with alkaline buffer reagent upon completion of prime cycles in Step 11, perform the following steps:

    (a) Remove line #25 from tubing holder. Leave line attached to debubbler.

    (b) Remove debubbler from mounting brackets and let hang upsidedown (numbering will be right side up).

    (c) Alkaline buffer will autoprime at one minute intervals. Leave debubbler upsidedown until autoprime fills debubbler to approximately half full.

    (d) Remount debubbler in mounting brackets with numbering upsidedown.

    (e) Reinstall tubing #25 in holder.

4.30.2 Electrolyte Reference Debubbler

1. Remove reagent line #2A from the electrolyte reference reagent bottle (Figure 4-254).

1 - Line #2A

Figure 4-254. Removing Reagent Bottle Lines

2. Prime the electrolyte reference reagent twenty times to empty the lines. Program the system as follows:

(a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

(b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

(c) Cursor and **SELECT** Electrolyte Reference Flow Cell.

(d) Press **F1 START PRIME**.

(e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

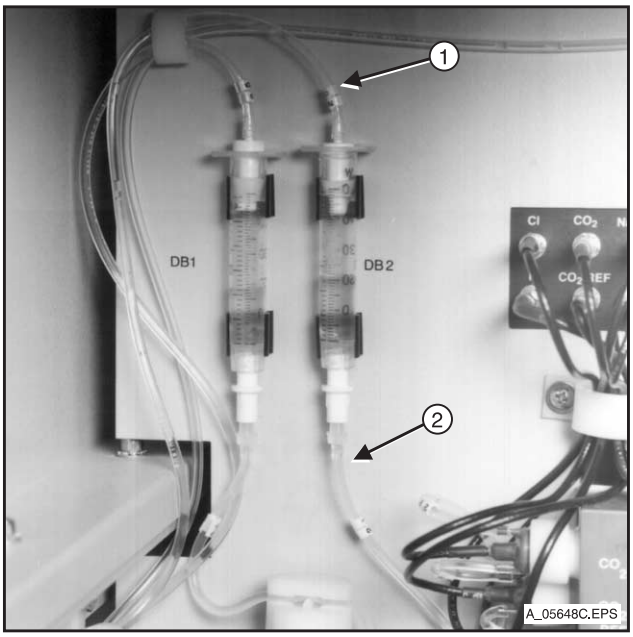
3. After priming is complete, assure the system is in STANDBY, then prevent the system from autopriming as follows:

(a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

(b) Cursor and **SELECT** 6. Prime or type **6** and **ENTER**.

(c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.

4. Ensure debubbler is empty. Remove input line #20 from top of debubbler and output line #21 from bottom of debubbler (Figure 4-255), by firmly grasping the debubbler with one hand and pulling lines off using a twisting motion with the other hand.



1 - Line #20
2 - Line #21

Figure 4-255. Remove Input and Output Lines from Debubbler

5. Remove debubbler from mounting brackets and discard.

6. Install new debubbler assembly with volume numbers upside down in mounting brackets.

7. Connect input line #20 to top of debubbler and output line #21 to bottom of debubbler.

8. Connect reagent line #2A to electrolyte reference reagent bottle.

9. Press **PREV SCREEN** to conclude this procedure. Allow system to reinitialize. Press **MASTER SCREEN**.

10. Prime the electrolyte reference reagent 30 times. While the system is priming, check for leaks. Stop the priming if any leaks are noticed and correct the problem. Program the system as follows:

(a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

(b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

(c) Cursor and **SELECT** Electrolyte Reference Flow Cell.

(d) Press **F1 START PRIME**.

(e) Operator is prompted to enter the number of prime cycles. Type **30** and press **ENTER**. The display indicates the number of primes remaining.

11. If debubbler assembly is not one-half full with alkaline buffer reagent upon completion of prime cycles in Step 10, perform the following steps:

(a) Remove line #20 from tubing holder. Leave line attached to debubbler.

(b) Remove debubbler from mounting brackets and let hang upsidedown (numbering will be right side up).

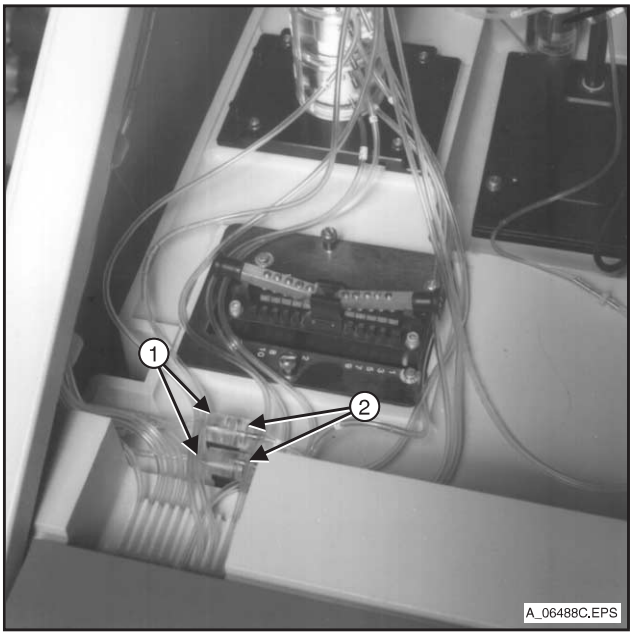
(c) Manually turn electrolyte peri-pump counterclockwise until debubbler is half full.

(d) Remount debubbler in mounting brackets with numbering upsidedown.

(e) Reinstall tubing #20 in tubing holder.

4.31 FLOW MIXER REPLACEMENT

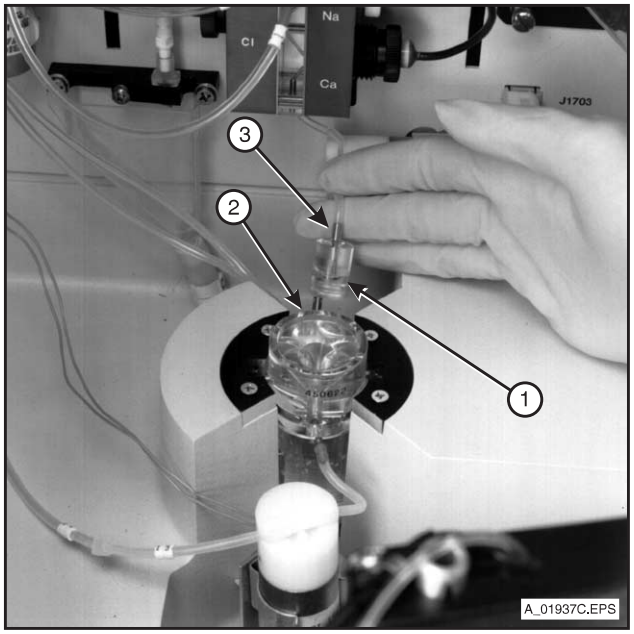
1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.
2. Slide flow mixer through mounting clamp (Figure 4-256).



1 - Flow Mixer
2 - Input End Groove

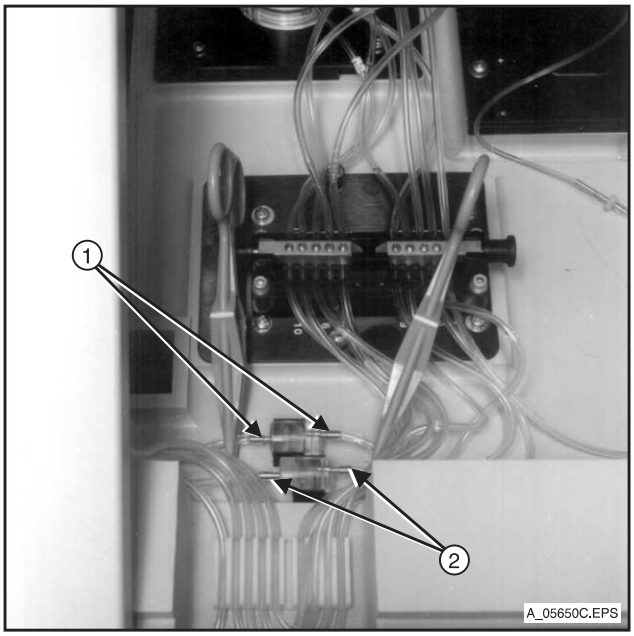
Figure 4-256. Flow Mixers

3. Using two hemostats, securely clamp the reagent input and output line for either the electrolyte buffer flow mixer (lines #3 and #12) or the CO2 acid reagent flow mixer (lines #5 and #11) or the flow cell flow mixer CX5 DELTA systems only (line #14 with line between the flow mixer and flow cell). Place hemostats approximately one inch (25mm) from the end of both sides of flow mixer to be replaced (Figures 4-257A and 4-257B).



A
1 - Flow Cell Mixer
2 - Line #14
3 - Line Between Flow Mixer and Flow Cell (CX5 DELTA system only)

Figure 4-257. Flow Cell Flow Mixer



B
1 - Lines #3 and #12
2 - Lines #5 and #11

Figure 4-257. Clamp Input and Output Lines of Flow Mixer

4. Remove tubing from flow mixer by firmly grasping flow mixer with one hand and pulling off tubing using a twisting motion with the other hand. Discard old flow mixer.

5. Install new flow mixer by first connecting reagent input and output lines.

NOTE

Input lines (#3 and #5 and #14) attach to the flow mixer connector which is off center. The input end is marked by a groove around the flow mixer. Output lines (#12 and #11 and the line between the flow mixer and flow cell) attach to the connector which is centered.

6. Remove hemostats.

7. Snap the flow mixer into place in its mounting clamp. Be sure to orient the mixer so that the right or input, tubing is as high as possible (refer to Figures 4-256, 4-257A and B).

8. Press **PREV SCREEN** to conclude this procedure. Allow system to reinitialize. Press **MASTER SCREEN**.

9. Prime the ratio pump five times to remove any bubbles which may be present in either the electrolyte buffer or the CO_2 acid flow mixers and lines. Program the system as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.

   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

   (c) Cursor and **SELECT** Ratio Pump.

   (d) Press **F1 START PRIME**.

   (e) Operator is prompted to enter the number of prime cycles. Type **5** and press **ENTER**. The display indicates the number of primes remaining.

10. Check for leaks while priming. If any are seen, stop priming and repair.

4.32 PINCH VALVE REMOVAL AND REPLACEMENT

1. Disconnect lines labeled #2A, #4A, #6A, #8A, and #10A from reagent bottles and wash bottle.

2. Prime the electrolyte buffer, CO_2 acid reagent, electrolyte reference reagent, and wash solution 20 times. Program the system as follows:

   (a) From the MASTER Screen, press **F4 SPECIAL FUNCITONS**.

   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.

   (c) Cursor and **SELECT** Ratio Pump.

   (d) Press **F1 START PRIME**.

   (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

3. From the MASTER Screen, Press **SYSTEM IDLE**. The screen prompts: “Continue with shut down procedure (Y/N)?”

4. Press **Y**, the **ENTER**. The screen will display:

   “SYSTEM IDLE” “ISE: STANDBY”
   “CONSOLE: “ “CX4: STANDBY”

5. Press **F4 RESUME**. The screen will prompt “This will reboot the system. Continue with the Resume procedure (Y/N)?”

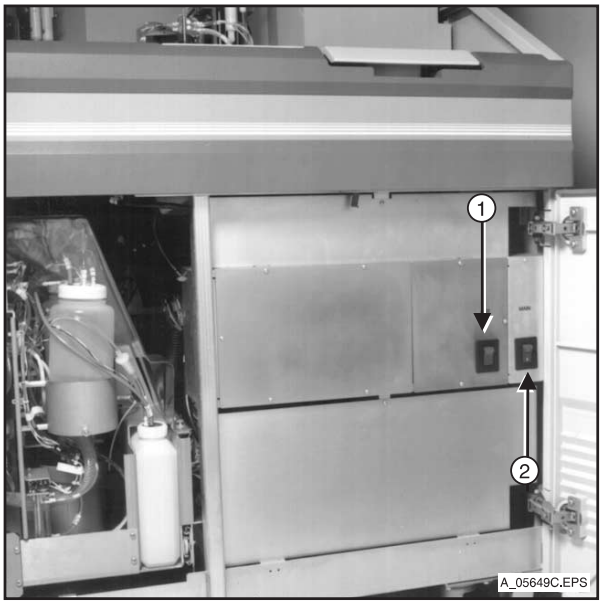
6. Press **Y**, then **ENTER**. The message display window will prompt: “Press <**PREV SCREEN**> to continue” (flashing message).

7. Press **PREV SCREEN**. A window will pop up giving four boot options.

8. Press **1**. A red “**POWER DOWN SCREEN**” will prompt you to: “Turn Off CX Instrument and/or PC Console Power Now.”

   (a) Turn the PC console power OFF using the switch on the front of the console unit.

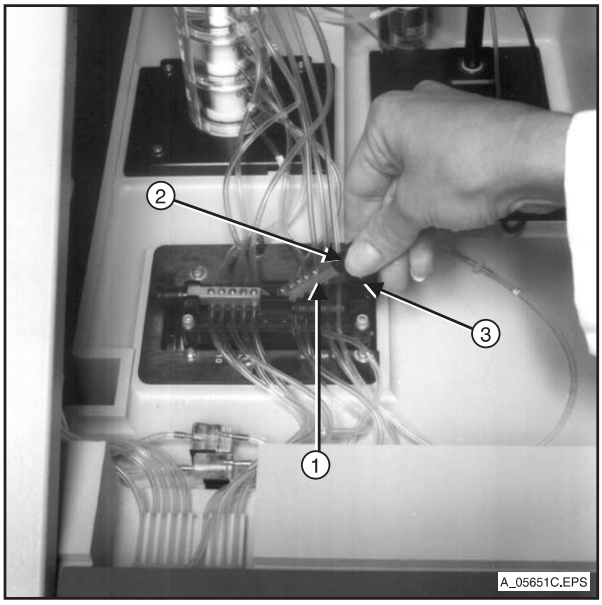
9. Press MAIN power switch behind the right front panel of the lower compartment to OFF (Figure 4-258). Leave AUX power switch ON. The green power light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-258. Power Switch

10. Release pressure bars by pulling out and lifting up on black release knob or loosen the screws that hold down the pressure bar (Figure 4-259).

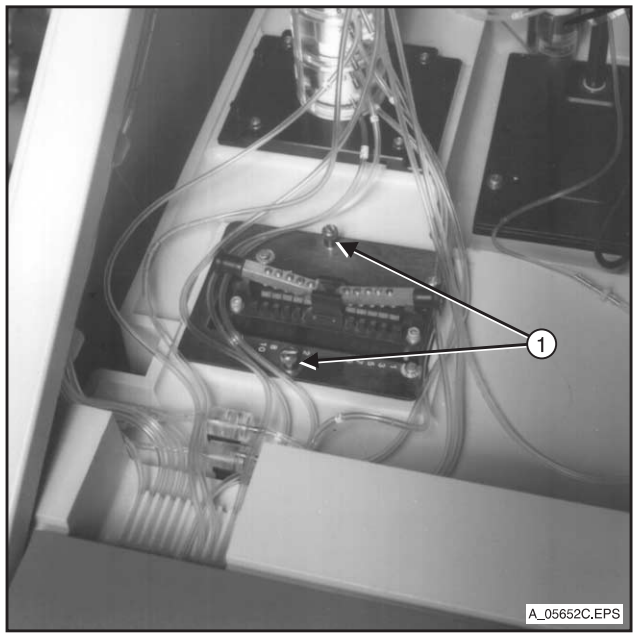


1 - Pressure Bar
2 - Release Knob
3 - Release Knob Holder

Figure 4-259. Release Pressure Bars

11. Remove all tubing from the pinch valve assembly

12. Unscrew two captive mounting screws (Figure 4-260).



1 - Captive Screws

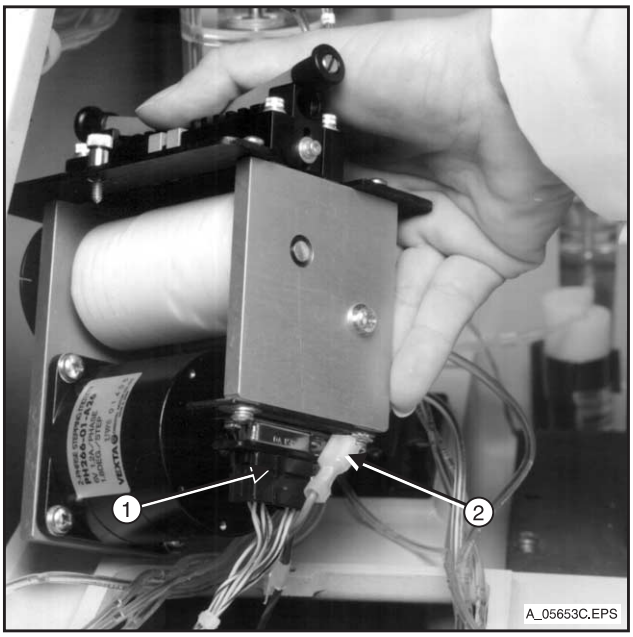
Figure 4-260. Captive Mounting Screws

13. While holding the tubing aside with one hand grasp the pinch valve assembly and remove it from the mounting location.

CAUTION

When removing the pinch valve, be careful not to catch any of the valve wiring on the sides of the valve opening. Damage may occur to the wiring.

14. Disconnect plug from socket on pinch valve assembly (Figure 4-261).



1 - Plug
2 - Ground Wire

Figure 4-261. "E" Pinch Valve Assembly Connectors

15. Remove ground wire from valve by holding the plastic-coated portion of the connector and pulling it away from the ground lug.
16. Connect socket to plug on back of the new pinch valve assembly.
17. Attach the ground wire to ground lug.
18. While holding the tubing aside with one hand, place new pinch valve assembly into mounting position. Odd-numbered lines on the right, even-numbered lines on the left.
19. Tighten the two captive mounting screws.
20. Open pressure bars. Place all reagent lines into their respective pinch valve slots.
21. Close pressure bars. Make sure release-bar knob engages holder at each end of pressure bar, or finger-tighten the screws.
22. Open right-hand cabinet door. Press MAIN power switch to ON position. The green MAIN power switch light will go ON. Close compartment door.
23. Turn the PC console power ON using the switch on the front of the console unit.
24. Reconnect lines labeled #2A, #4A, #6A, #8A, and #10A to reagent bottles and wash bottle.
25. Prime the electrolyte buffer, CO_2 acid reagent, electrolyte reference 20 times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCITONS**.
    (b) Cursor and **SELECT** 1. Prime or type 1 and **ENTER**.
    (c) Cursor and **SELECT** Ratio Pump.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

4.33 PERI-PUMP ASSEMBLY REPLACEMENT

NOTE

If more than one pump needs to be replaced, perform each replacement one at a time to avoid interchanging input and output lines.

To avoid spilling reagent or waste material, first remove the input line from the left side of the peri-pump tubing. Manually turn peri-pump counterclockwise five revolutions to evacuate the lines before attempting to replace peri-pump assembly.

Note that reagent flow through the pumps is in same direction as counterclockwise movement of pump rotor.

1. From the MASTER Screen, Press **SYSTEM IDLE**. The screen prompts: "Continue with shut down procedure (Y/N)?"
2. Press **Y**. The screen will display:

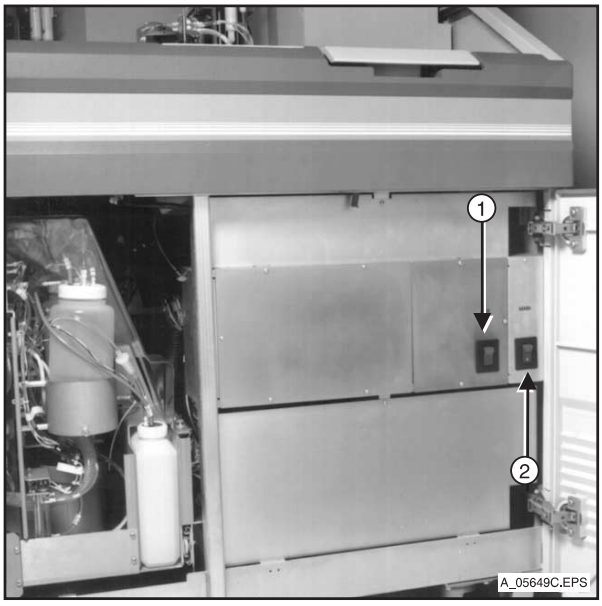
   "SYSTEM IDLE" "ISE: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

3. Press **F4 RESUME**. The screen will prompt "This will reboot the system. Continue with the Resume procedure (Y/N)?"
4. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).
5. Press **PREV SCREEN**. A window will pop up giving four boot options.

6. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."

   (a) Turn the PC console power OFF using the switch on the front of the console unit.

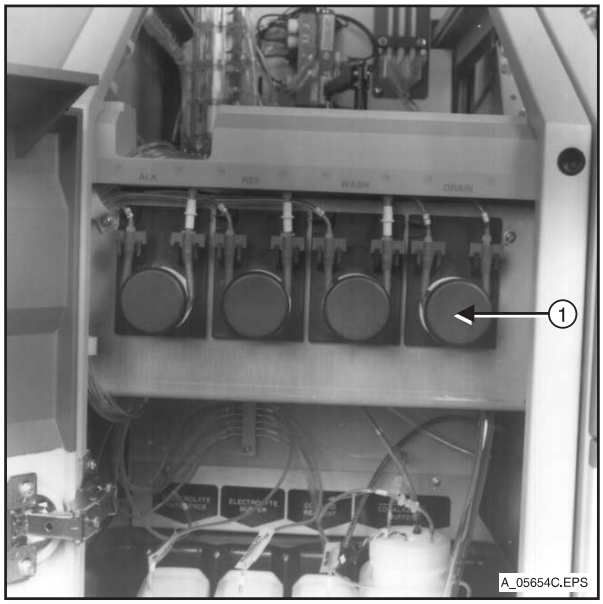
7. Press MAIN power switch behind the right front panel of the lower compartment to OFF (Figure 4-262). Leave AUX power switch ON. The green power light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-262. Power Switch

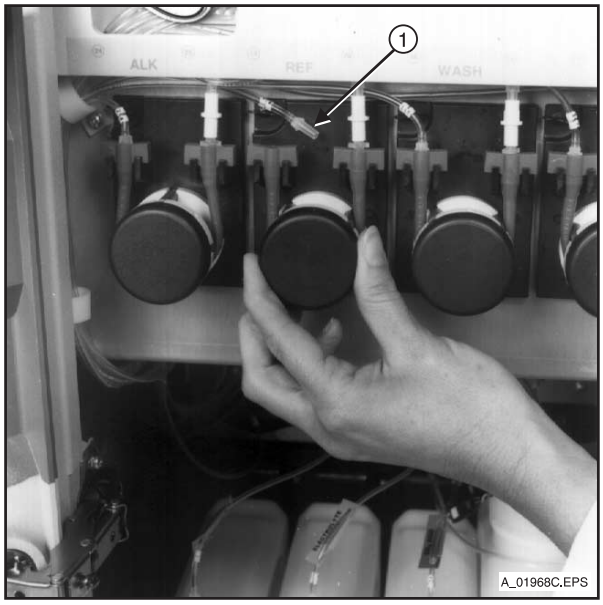
8. Open peri-pump compartment cover to expose peri-pump assemblies (Figure 4-263).



1 - Peri-pump Assemblies

Figure 4-263. Peri-Pump Compartment

9. For peri-pump assemblies, remove input line from peri-pump tubing (Figure 4-264).



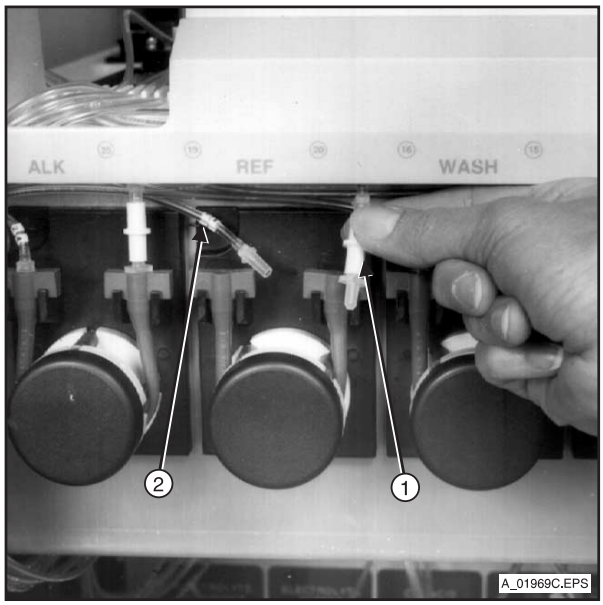
1 - Input Line

Figure 4-264. Remove Input Line from Peri-Pump

10. Manually rotate the peri-pump three to five revolutions counterclockwise to empty the lines (Figure 4-264).

11. Remove output line from pump tubings.

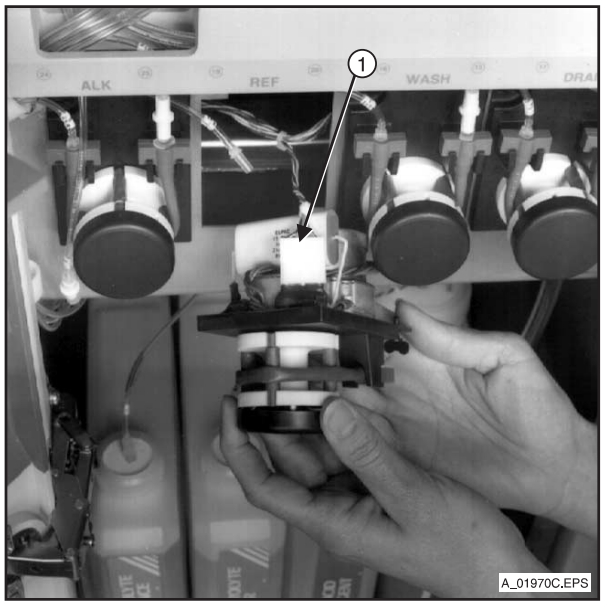
12. While supporting weight of pump assembly, turn wing nut at top left of pump assembly mounting plate (Figure 4-265) counterclockwise until completely loosened (about 1/4 turn).



1 - Output Line
2 - Wlng Nut

Figure 4-265. Loosen Wing Nut

13. Pull pump assembly away from module.
14. Unplug connector at back of pump assembly mounting plate. Discard old pump assembly (Figure 4-266).



1 - Connector

Figure 4-266. Unplug Connector

15. Plug in connector from new pump assembly at back of mounting plate. Connector is not keyed and can be connected either way.
16. Slide pump assembly into place, bottom half first. Push in wing nut and turn 1/4 turn clockwise to lock.
17. Ensure that the new pump is installed with new tubing. For instructions refer to the appropriate Operating Instructions.
18. Reattach input line to peri-pump tubing (left side).
19. Reattach output line to per-pump tubing (right side).
20. Open right-hand cabinet door. Press MAIN power switch to ON position. The green MAIN power switch light will go ON.
21. Turn the PC console power ON using the switch on the front of the console unit.
22. Inspect the system for leaks during initialization.
23. Prime peri-pump 15 times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCITONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** the appropriate reagent(s).
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **15** and press **ENTER**. The display indicates the number of primes remaining.
24. Close peri-pump compartment cover.

4.34 SAMPLE PROBE REPLACEMENT

1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
    (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
    (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.

2. Disconnect tubing from top of Sample Probe (Figure 4-267).

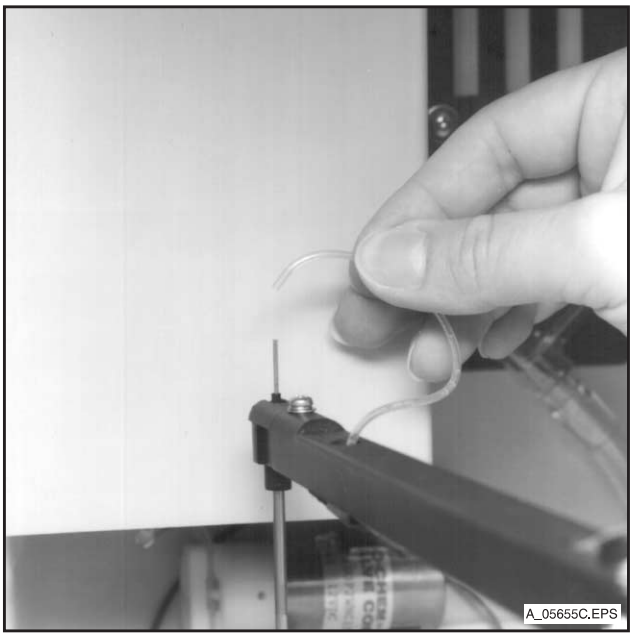


Figure 4-267. Disconnecting Tubing

3. Using a small Phillips screwdriver, remove the retaining screw on top of the probe arm (Figure 4-268).

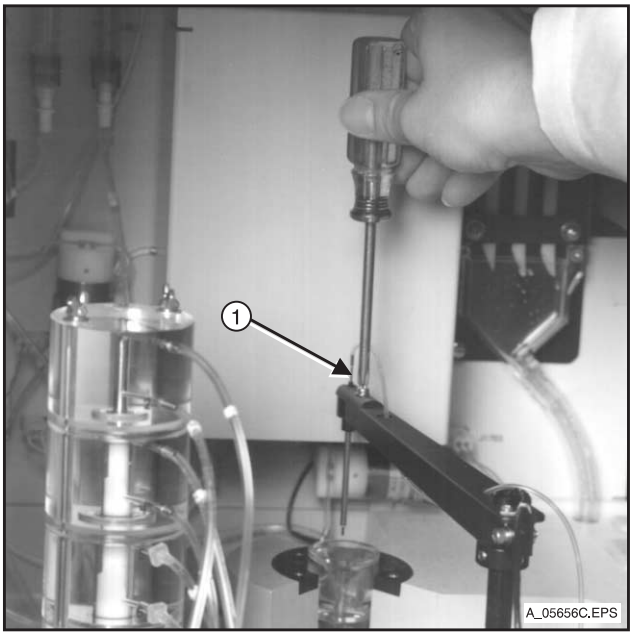
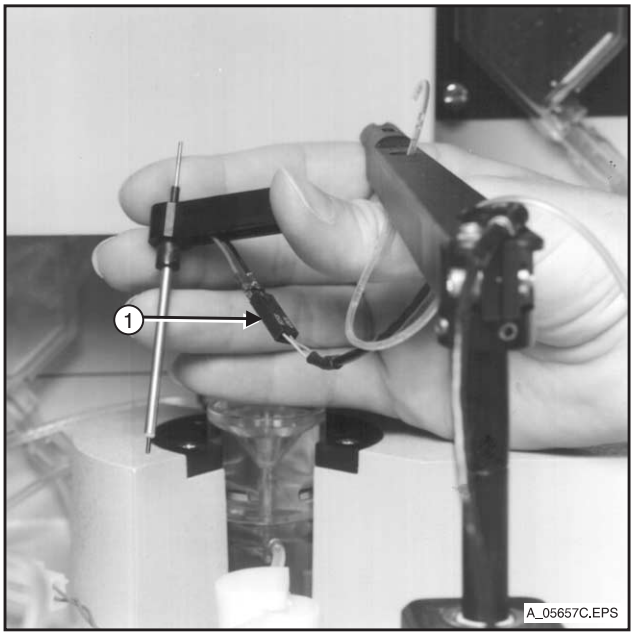


Figure 4-268. Removing Retaining Screw

4. Carefully grasp the probe tip assembly and pull it down and away from the probe arm.

5. Disconnect the wires beneath the probe arm by gently grasping the connector and pulling it apart (Figure 4-269). Discard old probe assembly.



1 - Probe Connector

Figure 4-269. Disconnecting Probe Connector

6. Reconnect the new probe assembly wires beneath the probe arm by gently grasping the connector and pushing it into the probe plug.

7. Install new probe assembly by inserting top of probe up through probe arm.

8. Install screw on top of probe arm. Leave screw loose for final adjustment.

9. Manually position crane arm over the sample mixing cup (Figure 4-270).

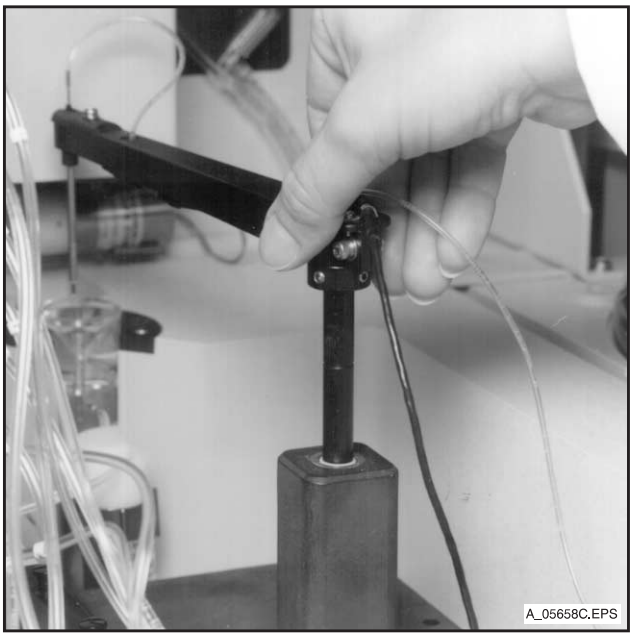


Figure 4-270. Positioning Crane Arm

NOTE

Use crane shaft to move probe up and down.

10. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize.
11. Perform ISE probe alignment procedures. For instructions, refer to Paragraph 3.14.2 followed by 3.5.12 and 3.5.13.

4.35 RATIO PUMP REPLACEMENT

1. Disconnect lines labeled #10A, #8A, #6A, #4A, and #2A from the DI water wash bottle and reagent bottles (Figure 4-271).

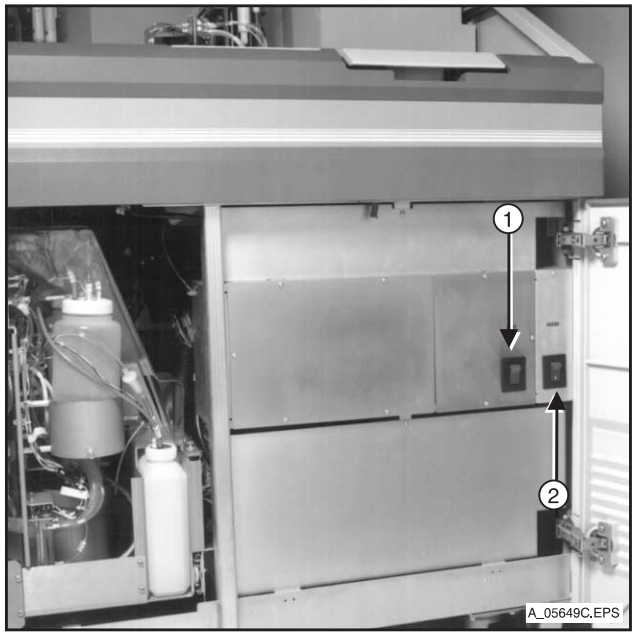
Figure 4-271. Reagent Lines.

2. Prime the ratio pump 20 times to evacuate the lines. Program the system as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
   (c) Cursor and **SELECT** Ratio Pump.
   (d) Press **F1 START PRIME**.
   (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.
3. From the MASTER Screen, Press **SYSTEM IDLE**. The screen prompts: "Continue with shut down procedure (Y/N)?"
4. Press **Y**, the **ENTER**. The screen will display:

   "SYSTEM IDLE" "ISE: STANDBY"
   "CONSOLE: " "CX4: STANDBY"

5. Press **F4 RESUME**. The screen will prompt "This will reboot the system. Continue with the Resume procedure (Y/N)?"
6. Press **Y**, then **ENTER**. The message display window will prompt: "Press <**PREV SCREEN**> to continue" (flashing message).

7. Press **PREV SCREEN**. A window will pop up giving four boot options.
8. Press **1**. A red "**POWER DOWN SCREEN**" will prompt you to: "Turn Off CX Instrument and/or PC Console Power Now."
   (a) Turn the PC console power OFF using the switch on the front of the console unit.
9. Turn MAIN power switch located behind the right front panel of the lower compartment to OFF (Figure 4-272). Leave AUX power switch ON. The green power light will go out. Close compartment door.



1 - AUX Power Switch
2 - MAIN Power Switch

Figure 4-272. Power Switches

10. Disconnect the lines leading into the pump (lines 1 through 10). by holding the top of the ratio pump with one hand and gently twisting the tubing while pulling outward with the other hand (Figure 4-273). Carefully remove ratio pump lines 5 and 6 to prevent damage to the fittings.

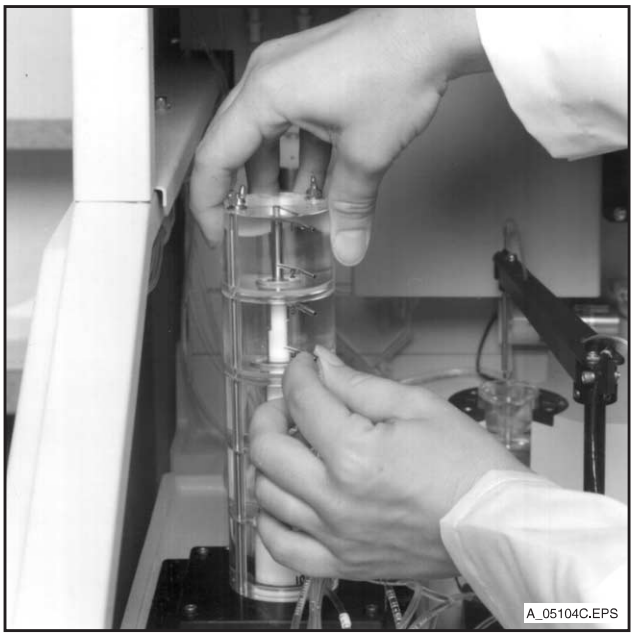
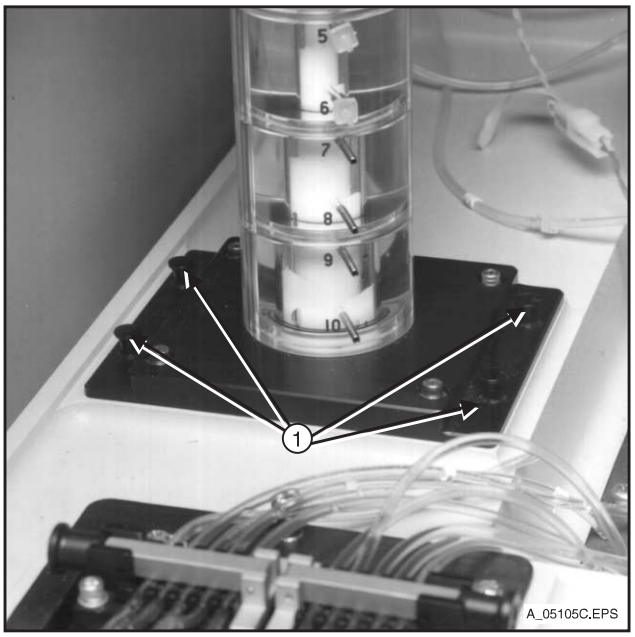


Figure 4-273. Disconnecting Lines

11. Pull up on all four mounting pins. Tilt pump forward and lift out (Figure 4-274).



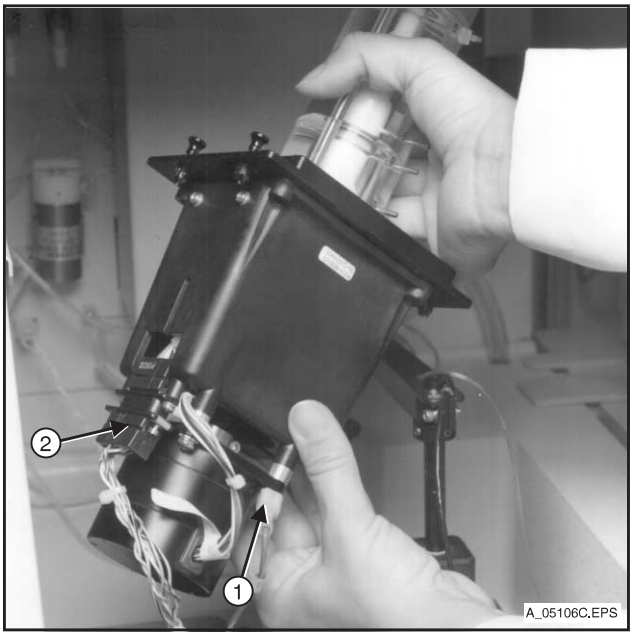
1 - Mounting Pins

Figure 4-274. Mounting Pins

NOTE

Do not allow connector or ground wire to fall inside of the instrument as retrieval may be difficult.

12. Grasp ground wire connector and gently pull away from ground lug (Figure 4-275).



1 - Ground Wire
2 - Plug

Figure 4-275. Ground Wire and Plug

13. Disconnect plug from socket on side of ratio pump.
14. Reconnect socket and ground wire to new ratio pump.
15. Install ratio pump with reagent line connections facing toward the front of the instrument. Push down on all four mounting pins.
16. Reconnect lines 1 through 10 to ratio pump (Figure 4-276).

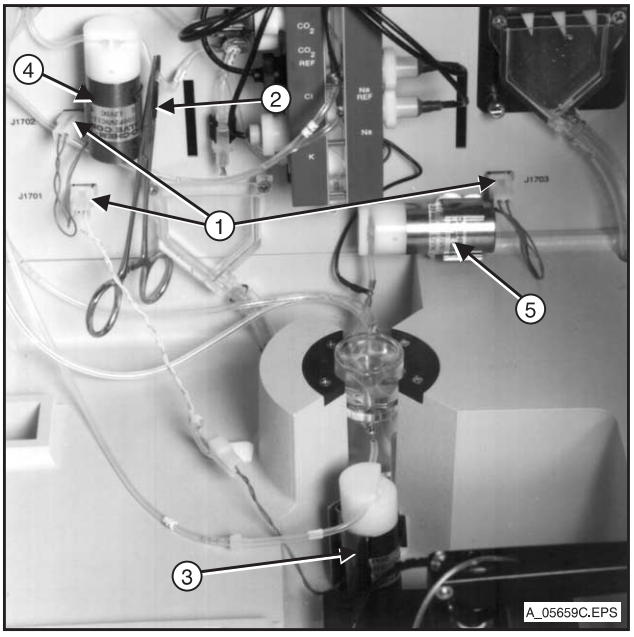
Figure 4-276. Reconnect Lines to Ratio Pump

17. Verify that wing nuts are finger-tight on top of the new ratio pump.
18. Reconnect reagent lines as follows:
    (a) #10A and #8A into DI Water Wash Bottle.
    (b) #4A into Electrolyte Buffer.
    (c) #6A into Acid Reagent.
    (d) #2A into Electrolyte Reference.
19. Open right-hand cabinet door. Press Main Power Switch to ON position. The green MAIN power switch light will go on. Close compartment door.
20. Turn the PC console power ON by using the switch on the front of the console unit.
21. Prime the ratio pump 20 times. Program the system as follows:
    (a) From the MASTER Screen, press **F4 SPECIAL FUNCITONS**.
    (b) Cursor and **SELECT** 1. Prime or type **1** and **ENTER**.
    (c) Cursor and **SELECT** Ratio Pump.
    (d) Press **F1 START PRIME**.
    (e) Operator is prompted to enter the number of prime cycles. Type **20** and press **ENTER**. The display indicates the number of primes remaining.

Check for leaks. Press **STOP** if any leaks are detected and repair.

4.36 SOLENOID VALVE REPLACEMENT

1. Assure that the system is in STANDBY, then prevent the system from autopriming as follows:
   (a) From the MASTER Screen, press **F4 SPECIAL FUNCTIONS**.
   (b) Cursor and **SELECT** 6. Maintenance or type **6** and **ENTER**.
   (c) Cursor and **SELECT** 7. ISE Prevent Autoprime or type **7** and **ENTER**.
2. Using a hemostat, securely clamp the line going through the defective solenoid approximately one inch (25 mm) from the solenoid (Figure 4-277).



1 - Connectors
2 - Hemostat
3 - Electrolyte Injection Solenoid
4 - Alkaline Buffer Solenoid
5 - Flow Cell Solenoid

Figure 4-277. Solenoid Valve Replacement

3. Grasp the tubing on both sides of the solenoid and gently pull the tube out of the solenoid.
4. Disconnect the solenoid cable from the connector.
5. Remove solenoid from mounting clamp by firmly grasping the solenoid and pulling. Discard defective solenoid.
6. Install new solenoid valve. Snap it into the mounting in the same orientation as the one just removed.
7. Plug solenoid connector into appropriate connector as follows:
   (a) Electrolyte Injection Cup –J1701
   (b) CO_2 Alkaline Buffer Solenoid –J1702
   (c) Flow Cell Solenoid –J1703
8. Install tubing in solenoid by holding the tubing on either side of the solenoid and working it into place.
9. Remove hemostat from tubing.
10. Press **PREV SCREEN** to conclude this procedure. Allow system to initialize. Press **MASTER SCREEN**.
11. Prime appropriate plumbing system as follows:
    (a) If the CO_2 alkaline buffer solenoid was replaced, prime "CO_2 Alkaline Buffer" three times.
    (b) If the flow cell pinch valve solenoid was replaced, prime "Ratio Pump" three times.
    (c) If the electrolyte injection cup solenoid valve was replaced, prime "ISE Was Solution" three times.
12. Check for leaks while priming. Stop priming and repair any observed leaks.

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PRECAUTIONS AND HAZARDS

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Section 5
PRECAUTIONS AND HAZARDS

This section lists the precautions and hazards associated with the SYNCHRON CX4, CX5, and CX7 Systems. Please read this information prior to operating the system.

5.1 CAUTIONS

5.1.1 CX4, CX5, and CX7

1. CX4, CX5, and CX7 System operating and performance characteristics and the instructions contained in this manual are based on the system hardware configuration specified by Beckman. Beckman disclaims all liability, including all warranties, whether expressed or implied, for CX4, CX5, and CX7 System performance when operated with other than the specified hardware configuration.
2. Use only factory-approved parts, reagents, wash solution and procedures to service the system.
3. If a diskette appears damaged, do not insert it into the disk drive. A scored diskette may damage a disk drive and subsequently all other diskettes placed into that drive. A scored diskette may also indicate a dirty or damaged disk drive. Call your local Beckman office for assistance (Refer to Appendix A, Sales and Service Offices).
4. There are no user-serviceable parts in the hydropneumatic drawer module other than those stated in the appropriate Operating Instructions and in the Diagnostics and Troubleshooting Guide.
5. Proper performance of the system requires maintenance as directed in the appropriate Operating Instructions.
6. When performing maintenance, service, or troubleshooting upon elements of the system that have contacted sera or other biological fluids, be aware of possible pathogen contamination. Do not handle sample or solutions without proper protection. Observe standard laboratory precautions. It is always necessary to wash your hands thoroughly after performing any routine maintenance.
7. When performing maintenance, wear safety glasses to protect your eyes.
8. The reagents and other chemical preparations used with the system will not normally cause adverse reactions; however, those persons with sensitive skin should wear protective rubber gloves before attempting to work with reagents and other chemical preparations.
9. When blood collection tubes which contain physical barriers are used, extra care should be exercised to ensure that the barrier is tightly packed. Loose particles from the barrier could coat or plug the sample probe, flow cell, reaction cups, electrolyte injection cup or cuvette washer.
10. Samples should be free of all visible fibrin. Clots could coat or plug the sample probe, flow cell, reaction cups, electrolyte injection cup or cuvette washer leading to instrument malfunction and/or short sampling.
11. Calibrators necessary for specific chemistries are described in the appropriate Operating Instructions. Be sure that the specified calibrator is in place for each calibration requested.
12. Calibrate with fresh calibrators after any of the following conditions:
    - Any maintenance or repair.
    - Any board or module adjustment.
    - Calibration set point modification or slope, offset adjustment.
    - System reset or restart (CX3/ISE chemistries).
    - CX3/ISE Reagent loading.
    - Loading a calibrator diskette.
13. To ensure optimum performance of the system, operate the system with reagent doors and all shields and covers in place.

14. Beckman Instruments recommends that at least two levels of control materials, normal and abnormal, should be analyzed daily. In addition, these controls should be run with each new calibration, with each new lot of reagent, and after specific maintenance or troubleshooting as detailed in the manuals. More frequent use of controls, or the use of additional controls, is left to the discretion of the user based on work load and work flow. However, the user should determine their own frequency based on the NCCLS Proposed Guideline C24-P INTERNAL QUALITY CONTROL TESTING: PRINCIPLES AND DEFINITIONS. This document recommends that "the user should define the period of time or series of measurements within which validation of the measurement process is important, based on sample stability, reporting intervals of patient results, cost of reanalysis, work flow patterns, operator characteristics, or similar non-analytical considerations which are in addition to the expected stability of the accuracy and precision of the measuring system."
15. While the Maintenance screen is active, the hydropneumatic system may automatically start during ISE/CX3 autoprime.
16. If triglyceride, cholesterol, HDL cholesterol or any other lipase or cholesterol esterase containing reagent are configured on the same instrument with Lipase reagent, perform the SYNCHRON Lipase Wash procedure before running each batch of Lipase tests. This procedure is described in the Limitation section of Lipase Chemistry Information Sheet in the Chemistry Information Manual.

5.1.2 CX7 Users Only:

1. After placing fresh CX3 wash solution on the system, perform a reagent load, then proceed to the following steps:
   (a) Prime BUN3, GLU3, and ratio pump five times.
   (b) Recalibrate sodium, potassium, chloride, CO_2, CALC (ISE), GLU3 and BUN3 before resuming normal operation.
2. After analysis of ten consecutive urine electrolytes, one replicate of the SYNCHRON CX Calibrator Level 3 standard should be run in the serum mode for electrolytes. This will eliminate the potential for chloride drift due to matrix effects of urine samples.
3. Reaction cup modules must always be reinstalled into the same positions as originally installed. These positions were carefully selected to provide a maximum in programming flexibility while maintaining a minimum interference due to reagent carryover.
4. Repetitive refrigeration of the SYNCHRON CX aqueous calibrators may facilitate crystal formation. Once removed from refrigeration storage, these calibrators should remain at room temperature. The calibrator once opened is stable for thirty (30) days, or the stated expiration date on the bottle label, whichever comes first.
5. The alkaline buffer reagent is stable for one month on the system. However, if a color change from pink to a lighter shade of pink should occur, replace with a fresh bottle of alkaline buffer reagent and refer to Section Nine of the appropriate Operating Instructions (Preventive Maintenance) for reagent load.
6. Changes in ambient temperature and environmental conditions may result in an "excessive reference drift" message and the electrolyte chemistries must be recalibrated.
7. When reinstalling any of the chemistry modules (BUN3, GLU3, CRE3, TP3 or CA3), be sure to properly align module to the sample probe. This will prevent damage from occurring to the sample probe.
8. When placing the chemistry shields back into position, be sure to properly reinstall the three thumbscrews and four retaining nuts before resuming normal operation of the system.
9. Failure to operate the system with sufficient electrolyte reagent will result in erroneous results for all CX3 chemistries. In some cases, results will be obtained without reagents. Therefore, before starting any run, verify that sufficient reagent is available to complete the run.
10. Reagent bottles should not be handled during a sample measurement period.
11. Do not use controls containing diethylamine HCL, if CALC (ISE) is on the system.

12. The following are the approximate minimum volumes:

    (a) **Microtubes**

        i. Fits in 13 X 100 mm sector only.

        ii. Bar code labels should be placed on Microtubes the same way that labels are placed on primary sample tubes.

        iii. Minimum volume requirements:

GLU3, TP3, CA3, BUN3 or CRE3	80 µL
TP3 (CSF)	140 µL
GLU3, CL, TP3 (all CSF)	240 µL
Electrolytes (any/all)	110 µL
All CX3 chems	190 µL
CX4 tests	60 µL dead volume + test volume

    (b) **Sample Cups**

        i. Available sizes are 0.5 mL and 2.0 mL.

        ii. Minimum volume requirements:

	0.5 mL	2.0 mL
TP3, CA3, BUN3 or CRE3 (1 only)	80 µL	150 µL
GLU3	110 µL	150 µL
TP3 (CSF)	160 µL	160 µL
GLU3, CL, TP3 (all CSF)	—	250 µL
Electrolytes (any/all)	110 µL	275 µL
All CX3 chems	210 µL	300 µL
CX4 tests	40 µL dead volume + test volume	175 µL dead volume + test volume

Calibration	Cup Size	Minimum Amount of Each Level of Calibrator
SYNCHRON CX Calibrators	2.0 mL	1060 µL
SYNCHRON CX Protein Calibrators	0.5 mL	110 µL

5.1.3 CX5 (ISE Module) Users Only

1. After analysis of ten consecutive urine electrolytes, one replicate of the SYNCHRON CX Calibrator Level 3 standard should be run in the serum mode for electrolytes. This will eliminate the potential for chloride electrode drift due to matrix effects of urine samples.

2. Repetitive refrigeration of the SYNCHRON CX aqueous calibrators may facilitate crystal formation. Once removed from refrigeration storage, these calibrators should remain at room temperature. The calibrator once opened is stable for thirty (30) days, or the stated expiration date on the bottle label, whichever comes first.

3. The alkaline buffer reagent is stable for one month on the system. However, if a color change from pink to a lighter shade of pink should occur, replace with a fresh bottle of alkaline buffer reagent and refer to Section Nine of the appropriate Operating Instructions (Preventive Maintenance) for reagent load.

4. Failure to operate the system with sufficient electrolyte reagent will result in erroneous electrolyte results. In some cases, results will be obtained without reagents. Therefore, before starting any run, verify that sufficient reagent is available to complete the run.

5. Reagent bottles should not be handled during a sample measurement period.

6. Changes in ambient temperature and environmental conditions may result in an “excessive reference drift” message and the electrolyte chemistries must be recalibrated.

7. Do not use controls containing diethylamine HCL, if CALC (ISE) is on the system.

8. Compartment light should be off during sample analysis due to possible heat generation.

9. The following are the approximate minimum volumes:

    (a) **Microtubes**

        i. Fits in 13 X 100 mm sector only.

        ii. Bar code labels should be placed on Microtubes the same way that labels are placed on primary sample tubes.

        iii. Minimum volume requirements:

Electrolytes (any/all)	110µL
CX4 tests	60 µL dead volume + test volume

    (b) **Sample Cups**

        i. Available sizes are 0.5 mL and 2.0 mL.

        ii. Minimum volume requirements:

	0.5 mL	2.0 mL
Electrolytes (any/all)	125 µL	275 µL
CX4 tests	40 µL dead volume + test volume	175 µL dead volume + test volume

5.2 HAZARDS

5.2.1 CX4, CX5, and CX7

WARNING

DO NOT UNDER ANY CIRCUMSTANCES OPERATE THE SYSTEM UNTIL AN ELECTRICAL GROUND IS PROVIDED AND THE POWER CORD IS PROPERLY CONNECTED TO THE GROUND.

1. Disconnect the power cord when performing service procedures such as replacing circuit boards or mechanical components. Always use the antistatic wrist strap located in the electronic board compartment when removing or installing any circuit board.
2. The three-pronged power cord must be connected only to a matching three-wire grounded outlet. DO NOT use an adapter to connect the power plug to a two-pronged outlet.
3. Replacement or servicing of any components where contact with bare, live hazardous parts could occur, possibly resulting in electrical shock, should only be performed by qualified service personnel.
4. Do not use in the presence of flammable materials possible explosion hazard.
5. Do not place hands near any moving parts while the system is operating.
6. Observe all laboratory policies or procedures which pertain to handling of infectious and pathogenic materials.
7. System operation should be consistent with power requirements as stated in the appropriate Operating Instructions.
8. Do not tamper with or remove housing of sample bar code reader. The sample bar code reader is a class II moving beam laser scanner. When the instrument status on the console displays the message “Running”, “Homing”, or “Diagnostics”, the laser may be on. At all other times, the laser is off.

5.3 CAUTION/WARNING LABELS AND SYMBOLS

The following cautionary/warning labels appear in the indicated places on the SYNCHRON CX:

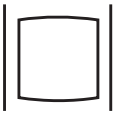
Protective Conductor Terminal

A_00044C.EPS

Printer

A_00484C.EPS

Video Display Terminal

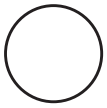


A_00045C.EPS

Main Power On

A_00052C.EPS

Main Power Off

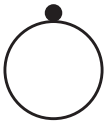


A_00053C.EPS

Printer/Terminal Power On

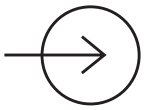
A_00485C.EPS

Printer/Terminal Power Off



A_00486C.EPS

Signal Input



A_00487C.EPS

Sample Bar Code Reader

A_00049C.EPS

Sample Bar Code Reader

A_00050C.EPS

Sample Bar Code Reader

A_00051C.EPS

Carousel Covers (3)

A_00566C.EPS

Carousel Covers (3)

A_00571C.EPS

5.4 WARNINGS

WARNING
MANUAL CUP ASSIGNMENTS

Prior to loading sectors for use in the barcode mode of operation or programming additional manual cup assignments for a specific sector, ALL manual cup assignments must be cleared. Failure to clear manual cup assignments could result in test results matched with inappropriate patient IDs and demographics.

WARNING
CALIBRATOR AND CONTROL SAMPLE BARCODE IDs

When creating calibrator, calibration verification or control barcode IDs, use a format that distinctly differs from that used for sample IDs. This will prevent the reporting of erroneous results due to calibrators or controls being run as patient samples, or patient samples being run as calibrators or controls.

For example	Calibrator Barcode ID	:	CXMULTI
	Sample ID	:	0000001

WARNING

TIMED URINE as a sample type for Reference Ranges (normal and/or critical) is not completely functional at this time. Therefore, it is recommended that TIMED URINE not be used to establish reference ranges. Operators should be aware that if TIMED URINE is the designated sample type for a given reference range, that the range will be applied to the aliquot result rather than the calculated result, and that no flags will be generated. In addition, critical reference ranges are not applied to samples with a sample type of RANDOM URINE.

WARNING

The CX4, CX5, and CX7 calculates and reports the pre-programmed calculations in default units (refer to Table 6-12 in the Operating Instructions), regardless of the units selected by the operator in System Setup. The only exceptions are UREA/CREA, UREA3/CREA3, or UREA/CR-T which use operator-selected units.

To report calculated values which reflect units other than default units, the operator must create and enable a Custom Calculation. The system applies conversion factors to the custom calculations to account for differences between default units and alternative operator-selected units.

WARNING

The CX4, CX5, and CX7 Patient Multiple Sample Report is not recommended as a patient chartable report, as a reference for verbal reports, or for transcription to written reports which would appear on patient charts. This report format does not contain sample limit flags or instrument codes.

WARNING
QC DEFINE/REVIEW

If QC Define/Review is accessed while a control is being run on the system, the control results may not be included in the cumulative statistics. To ensure accurate cumulative statistics, it is recommended that QC Define/ Review be accessed when the system is in Standby, or when controls are not being run.

WARNING
SECTORS

Only amber colored SYNCHRON sectors labeled CENTRIFUGE can be centrifuged. Previous models of SYNCHRON sectors will not withstand the force of centrifugation and may be damaged if centrifuged.

WARNING

Creatinine clearance calculations using serum creatinine values downloaded from the host in other than default units (mg/dL), will result in erroneous answers. Serum creatinine values must be received from the host in default units (mg/dL) for creatinine clearance calculations to be performed correctly.

WARNING

Do not program tests requiring pre-treated samples (e.g., IgG, IgA, IgM, HDL, TRF) with non pre-treated tests.

WARNING

After loading new multi-point calibration (>2 calibration points) diskette(s), all chemistries associated with those diskettes MUST be recalibrated before samples are run to avoid incorrect information being applied to the results.

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CX® PRO TROUBLESHOOTING

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Section 6
CX® PRO TROUBLESHOOTING

6.1 CX PRO HARDWARE AND SOFTWARE ERROR CODES

System errors, which can be hardware or software in nature, will either generate an error window or appear on the first line of the message box informing the operator that a problem exists. An error in the message box occurs if the problem exists in response to the operator performing a direct action on the system. If an error message appears that is not listed herein, call your local Beckman Coulter service representative.

6.1.1 Error Messages Generated While Running CX PRO Obstruction Detection and Correction Feature

6.1.1.1 CX4 ERROR MESSAGES (CX7 PRO or CX9 PRO users)

MESSAGE:	OBSTRUCTION DETECTION ERROR.
CAUSE:	Clot detected in sample probe.
CORRECTIVE ACTION:	Clean the CX4 sample probe only if the system cannot clear the clot automatically through the wash cycle. Refer to the CX Clinical Systems *Operating Instructions* for cleaning instructions.
MESSAGE:	OBSTRUCTION CANNOT BE CLEARED. SAMPLE PROBE NEEDS CLEANING. NO MORE TESTS WILL BE SCHEDULED.
CAUSE:	Clot detected in sample probe at CX4 side. Wash cycle cannot clear the obstruction.
CORRECTIVE ACTION:	Clean the CX4 sample probe. Refer to the CX Clinical Systems *Operating Instruction*s for cleaning instructions.
MESSAGE:	TOO MANY CONSECUTIVE SAMPLE CLOTS DETECTED. NO MORE TEST WILL BE SCHEDULED.
CAUSE:	Clot detected in three consecutive samples.
CORRECTIVE ACTION:	1. Press the HOME key to verify if there are clots in the samples. 2. Press the START key when the instrument returns to the STANDBY state. 3. Clean the CX4 sample probe. Refer to the SYNCHRON CX Clinical Systems *Operating Instructions* for cleaning instructions.

MESSAGE:	SYSTEM IS STOPPING. OBSTRUCTION DETECTION DEVICE ERROR.
CAUSE:	Obstruction detection pressure transducer is not responding at CX4 side.
CORRECTIVE ACTION:	1. Check pressure transducer for loose electrical connection at MSC3 circuit board. 2. Repeat the Obstruction Detection and Correction calibration procedure. Refer to the CX Clinical Systems *Operating Instructions* for calibration instructions. 3. If the error message continues, contact your local Beckman Coulter service representative.

6.1.1.2 CX3/ISE ERRORS MESSAGES (CX5 PRO, CX7 PRO or CX9 PRO users)

MESSAGE:	CX3/ISE OBSTRUCTION WASH CUP IS ALMOST FULL.
CAUSE:	Obstruction wash cup is almost full.
CORRECTIVE ACTION:	1. Remove current wash cup at CX3/ISE side and replace with a new wash cup. 2. Press the “Y” key to reset counter.
MESSAGE:	CX3/ISE OBSTRUCTION WASH CUP IS FULL. PLEASE REFER TO USER MANUAL. NO MORE TESTS WILL BE SCHEDULED.
CAUSE:	Obstruction wash cup is full.
CORRECTIVE ACTION:	1. Remove current wash cup at CX3/ISE side and replace with a new wash cup. 2. Press the “Y” key to reset counter.
MESSAGE:	OBSTRUCTION DETECTION ERROR.
CAUSE:	Clot detected in sample probe.
CORRECTIVE ACTION:	Clean the CX3/ISE sample probe only if the system cannot clear the clot automatically through the wash cycle. Refer to the SYNCHRON CX Clinical Systems Operating Instructions for cleaning instructions.
MESSAGE:	OBSTRUCTION CANNOT BE CLEARED. SAMPLE PROBE NEEDS CLEANING. NO MORE TESTS WILL BE SCHEDULED.
CAUSE:	Clot detected in sample probe at CX3/ISE side. Wash cycle cannot clear the obstruction.
CORRECTIVE ACTION:	Clean the CX3/ISE sample probe. Refer to the CX Clinical Systems *Operating Instructions* for cleaning instructions.

MESSAGE:	SYSTEM IS STOPPING. OBSTRUCTION DETECTION DEVICE ERROR.
CAUSE:	Obstruction detection pressure transducer is not responding at CX3/ISE side.
CORRECTIVE ACTION:	1. Check pressure transducer for loose electrical connection at MCB circuit board. 2. Repeat the Obstruction Detection and Correction calibration procedure. Refer to the SYNCHRON CX Clinical Systems *Operating Instructions* for calibration instructions. 3. If the error message continues, contact your local Beckman Coulter service representative.

Appendix A
SALES AND SERVICE

Call the nearest Beckman Coulter Representative.

Appendix B
EVENT LOG IDENTIFICATIONS

EVENT #	TYPE
1	Keystrokes
2	Special Calculations
3	CX3 Instrument/ISE Module
4	CX4 Instrument
5	Database Manager
6	Display Manager
7	Scheduler/Tube Addition
8	Printer
9	Host Communications
10	Results Handler
11	Results Recall
12	Calibration
13	Sample Programming
14	Quality Control
15	Reagent Load
16	Setup
17	Prime
18	Diagnostics/Maintenance
19	Sample Wheel Status
20	Event Logger/System
21	SCSI Communications
22	SCSI Messages

Appendix C
LED DESCRIPTIONS

CX3 BOARD LED DESCRIPTIONS

(Please refer to Figure C-1 or C-2)

CX3 ANALOG TO DIGITAL CONVERTOR (ADC) BOARD (P/N 442915) (PKG'D P/N 443624)

LED	CONDITION	DESCRIPTION
DS1	ON	Converting data
DS2	ON	Converting data

CX3 RANDOM ACCESS MEMORY (RAM) BOARD (P/N 443243) (PKG'D P/N 443641)

LED	CONDITION	DESCRIPTION
LED1	ON	Parity error

CX3 MOTION DRIVER (MDR1) BOARD 1 (P/N 756680) (PKG'D P/N 756886)

LED	CONDITION	DESCRIPTION
DS1	ON	Motor disabled
DS2	ON	E Cam pinch valve phase 4 +12V
DS3	ON	E Cam pinch valve phase 3 +12V
DS4	ON	E Cam pinch valve phase 2 +12V
DS5	ON	E Cam pinch valve phase 1 +12V
DS6	ON	C Cam pinch valve phase 4 +12V
DS7	ON	C Cam pinch valve phase 3 +12V
DS8	ON	C Cam pinch valve phase 2 +12V
DS9	ON	C Cam pinch valve phase 1 +12V
DS10	ON	Crane vertical stepper motor phase 4
DS11	ON	Crane vertical stepper motor phase 3
DS12	ON	Crane vertical stepper motor phase 2
DS13	ON	Crane vertical stepper motor phase 1
DS14	ON	Crane rotational stepper motor phase 4
DS15	ON	Crane rotational stepper motor phase 3
DS16	ON	Crane rotational stepper motor phase 2
DS17	ON	Crane rotational stepper motor phase 1

CX3 MOTION DRIVER (MDR1) BOARD 1 (P/N 756680) (PKG'D P/N 756886) (Continued)

LED	CONDITION	DESCRIPTION
DS18	ON	Ratio pump phase 4 +12V
DS19	ON	Ratio pump phase 3 +12V
DS20	ON	Ratio pump phase 2 +12V
DS21	ON	Ratio pump phase 1 +12V
DS22	OFF	Ratio pump home
DS23	OFF	Crane rotational detent
DS24	OFF	Crane rotation home
DS25	OFF	Crane vertical home
DS26	OFF	Peri-pump active
DS27	OFF	C Cam pinch valve active
DS28	OFF	E Cam pinch valve active

CX3 MOTION DRIVER (MDR2) BOARD 2 (P/N 442957) (PKG'D P/N 443651)

LED	CONDITION	DESCRIPTION
DS1	ON	Motor disabled
DS2	ON	Stepper motor phase on
DS3	ON	Peri-pump or solenoid valve on
DS4	ON	Probe level sense circuit active
DS5	ON	Continuity (fluid sensed)

INPUT/OUTPUT and SMALL COMPUTER SYSTEM INTERFACE COMMUNCIATION (I/O SCSI) BOARD (P/N 467779) (DELTA Systems only)

LED	CONDITION	DESCRIPTION
LD1	ON	I/O interrupt in process

CX4 BOARD LED DESCRIPTIONS

(Please refer to Figure C-1 or C-2)

CX4 ANALOG TO DIGITAL CONVERTOR (ADC) BOARD (P/N 758104)

TP (Test Point)	SIGNAL DESCRIPTION
TP-1	Log channel 1 signal
TP-2	Log channel 2 signal
TP-3	Log channel 3 signal
TP-4	Log channel 4 signal
TP-5	Log channel 5 signal
TP-6	Reference ground

ADJUSTABLE RESISTOR	DESCRIPTION
R2	Log channel 1 adjust
R9	ADC offset adjust
R13	Log channel 2 adjust
R22	Log channel 3 adjust
R34	Log channel 4 adjust
R42	Log channel 5 adjust

CX4 MASTER ANALOG CONTROLLER (MAC) BOARD (P/N 758110)

LED	CONDITION	DESCRIPTION
DS1	ON	Diagnostic
DS2	ON	Lamp trigger
DS3	ON	Reaction carousel HOME sensor tripped
DS4	ON	Reaction carousel SERVICE sensor tripped

CX4 MASTER MOTION CONTROLLER (MMC) BOARD (P/N 756875)

LED	CONDITION	DESCRIPTION
CR3	ON	+5V DC VM
CR1	ON	Processor reset nsc800
CR2	ON	Time out interrupt

SYSTEM I/F BOARD (P/N 758152)

LED	CONDITION	DESCRIPTION
CR8	ON	Cathode of trigger
CR7	ON	Cathode of set point

MEMORY (MEM) BOARD (P/N 759614)

LED	CONDITION	DESCRIPTION
GREEN	ON	Access (data write complete with no parity error)
RED	ON	Parity error

CENTRAL PROCESSING UNIT (CPU) BOARD (P/N 756629)

LED	CONDITION	DESCRIPTION
DS1	ON	Reset

INPUT/OUTPUT and SMALL COMPUTER SYSTEM INTERFACE COMMUNCIATION (I/O SCSI) BOARD (P/N 467779) (DELTA Systems only)

LED	CONDITION	DESCRIPTION
LD1	ON	I/O interrupt in process

LIQUID LEVEL SENSE BOARD (P/N 758570)

LED	CONDITION	DESCRIPTION
CR11	ON	
CR12	ON	Sample liquid sensed
CR14	ON	
CR15	ON	Reagent liquid sensed

HEATER CONTROLLER BOARD - REACTION CAROUSEL (P/N 758100)

LED	CONDITION	DESCRIPTION
CR4	ON	Board in correct slot
CR3	ON	Temperature in range
CR2	ON	Board enable
CR1	ON	Heater ON

HEATER CONTROLLER BOARD - WASH (P/N 758574)

LED	CONDITION	DESCRIPTION
CR4	ON	Board in correct slot
CR3	ON	Temperature in range
CR2	ON	Board enable CR1
CR1	ON	Heater ON

HEATER CONTROLLER BOARD - RINSE (P/N 758574)

LED	CONDITION	DESCRIPTION
CR4	ON	Board in correct slot
CR3	ON	Temperature in range
CR2	ON	Board enable
CR1	ON	Heater ON

MOTOR SYSTEM CONTROLLER (MSC) BOARDS (P/N 758140)

MSC-1

LED	CONDITION	DESCRIPTION
CR25	ON	Enable reaction carousel
CR24	ON	Enable reagent carousel
CR20	ON	Reaction carousel at HOME
CR23	NOT IN USE	
CR21	NOT IN USE	
CR22	ON	Reagent carousel at HOME
CR13	NOT IN USE	
CR12	NOT IN USE	
CR14	ON	Reagent carousel motor phase on
CR15	ON	Reagent carousel motor phase on
CR9	NOT IN USE	CR8
CR8	NOT IN USE	
CR10	ON	Reaction carousel motor phase on
CR11	ON	Reaction carousel motor phase on

MSC-2

LED	CONDITION	DESCRIPTION
CR25	ON	Enable sample pipette up/down and rotate
CR24	ON	Enable sample mixer up/down and rotate
CR20	ON	Sample pipette up/down HOME
CR23	ON	Sample mixer rotate HOME
CR21	ON	Sample pipette rotate HOME
CR22	ON	Sample mixer up/down HOME
CR13	ON	Sample mixer rotate motor phase on
CR12	ON	Sample mixer rotate motor phase on
CR14	ON	Sample mixer up/down motor phase on
CR15	ON	Sample mixer up/down motor phase on
CR9	ON	Sample pipette rotate motor phase on
CR8	ON	Sample pipette rotate motor phase on
CR10	ON	Sample pipette up/down motor phase on
CR11	ON	Sample pipette up/down motor phase on

MSC-3

LED	CONDITION	DESCRIPTION
CR25	ON	Enable reagent pipette up/down and rotate
CR24	ON	Enable reagent mixer up/down and rotate
CR20	ON	Reagent pipette up/down HOME
CR23	ON	Reagent mixer rotate HOME
CR21	ON	Reagent pipette rotate HOME
CR22	ON	Reagent mixer up/down HOME
CR13	ON	Reagent mixer rotate motor phase on
CR12	ON	Reagent mixer rotate motor phase on
CR14	ON	Reagent mixer up/down motor phase on
CR15	ON	Reagent mixer up/down motor phase on
CR9	ON	Reagent pipette rotate motor phase on
CR8	ON	Reagent pipette rotate motor phase on
CR10	ON	Reagent pipette up/down motor phase on
CR11	ON	Reagent pipette up/down motor phase on

MSC-4

LED	CONDITION	DESCRIPTION
CR25	ON	Enable sample syringe and valve
CR24	ON	Enable reagent syringe and valve
CR20	ON	Sample valve HOME
CR23	ON	Sample syringe HOME
CR21	ON	Reagent valve HOME
CR22	ON	Reagent syringe HOME
CR13	ON	Sample syringe motor phase on
CR12	ON	Sample syringe motor phase on
CR14	ON	Sample valve phase on
CR15	ON	Sample valve motor phase on
CR9	ON	Reagent syringe motor phase on
CR8	ON	Reagent syringe motor phase on
CR10	ON	Reagent valve motor phase on
CR11	ON	Reagent valve up/down motor phase on

LED	CONDITION	DESCRIPTION
CR25	ON	Enable sample carousel and autoloader
CR24	ON	Enable wash station
CR20	ON	Sample carousel HOME
CR23	NOT IN USE	
CR21	ON	Autoloader HOME
CR22	ON	Wash station HOME
CR13	NOT IN USE	
CR12	NOT IN USE	
CR14	ON	Wash station phase on
CR15	ON	Wash station motor phase on
CR9	ON	Autoloader motor phase on
CR8	ON	Autoloader motor phase on
CR10	ON	Sample carousel motor phase on
CR11	ON	Sample carousel up/down motor phase on

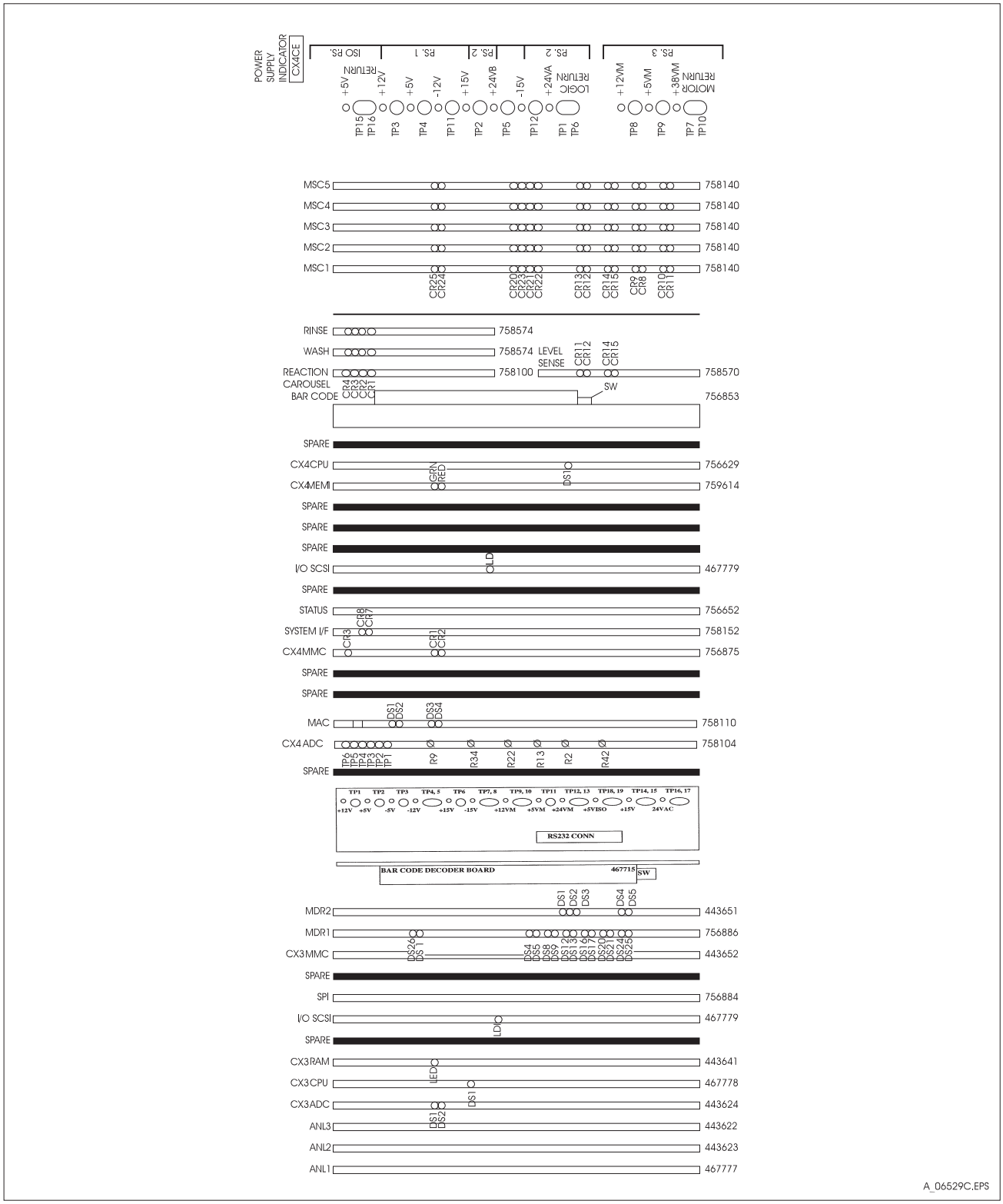

Figure C-1. CX4/CX7 DELTA Board Locations

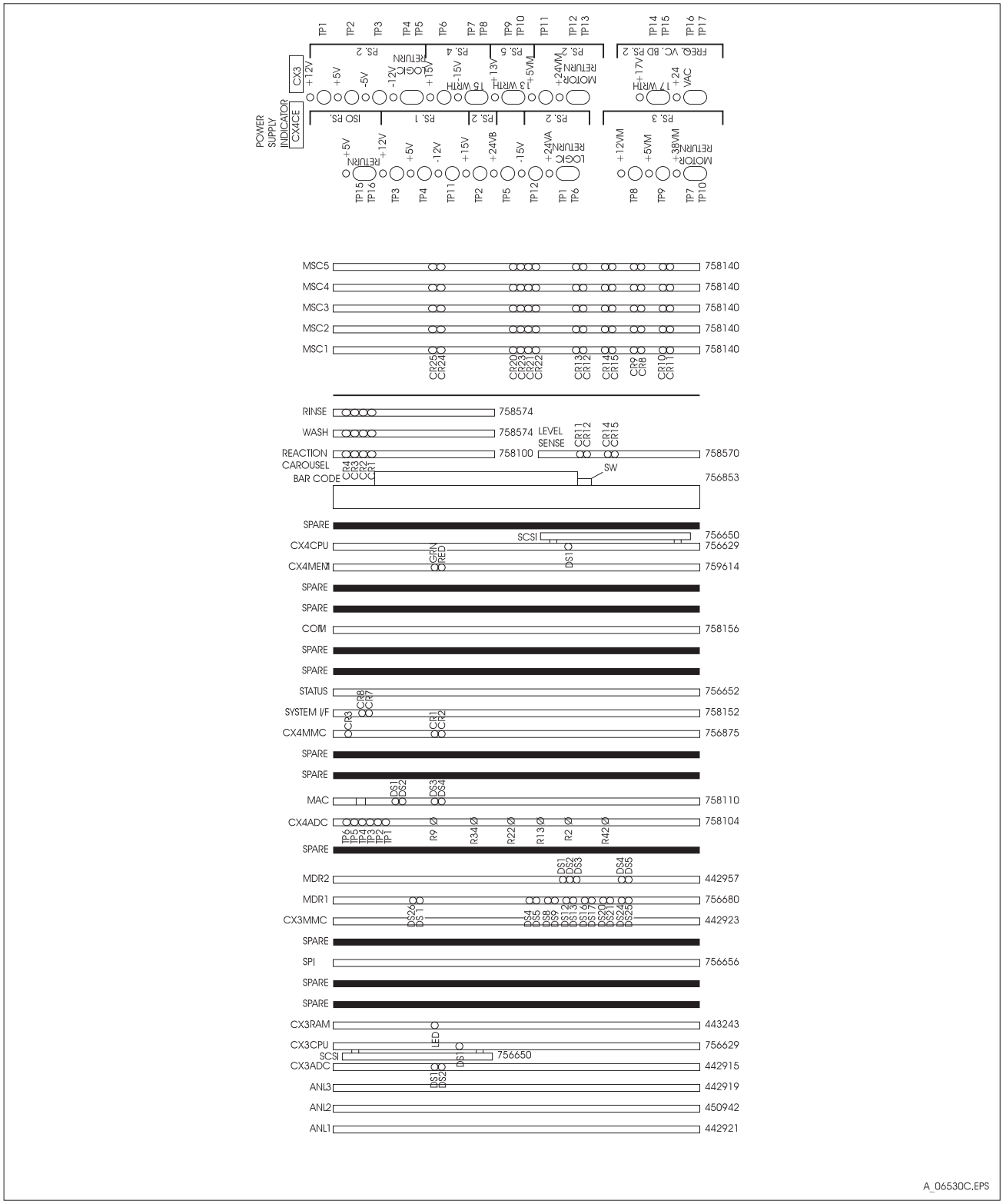

Figure C-2. CX4CE/CX7 Board Locations

CX5 BOARD LED DESCRIPTIONS

(Please refer to Figure C-3 or C-4)

SENSOR/STATUS BOARD (P/N 440606)

LED	CONDITION	DESCRIPTION
DS4	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS8	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS5	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS8	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS6	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS3	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS7	GREEN	Voltage is within tolerance
	RED	Voltage is outside of tolerance
DS1	ON	Fluid level sense enable
DS2	ON	Level sense = true

ISE ADC BOARD (P/N 442915)

LED	CONDITION	DESCRIPTION
DS2	NOT IN USE	Not applicable
DS1	ON	Converting data
	OFF	Data valid

ISE MOTION DRIVER BOARD (P/N 440612)

LED	CONDITION	DESCRIPTION
DS2	ON	Stepper motor phase on
DS4	ON	Sample crane at vertical home
DS7	ON	Sample crane at rotary detent
DS5	ON	“E” cammed pinch valve at detent
DS8	ON	Ratio pump at home
DS6	ON	Sample crane at rotary home
DS1	OFF	Motor disabled
DS3	ON	Peri-pump or solenoid valve on

INPUT/OUTPUT and SMALL COMPUTER SYSTEM INTERFACE COMMUNCIATION (I/O SCSI) BOARD (P/N 467779) (DELTA Systems only)

LED	CONDITION	DESCRIPTION
LD1	ON	I/O interrupt in process

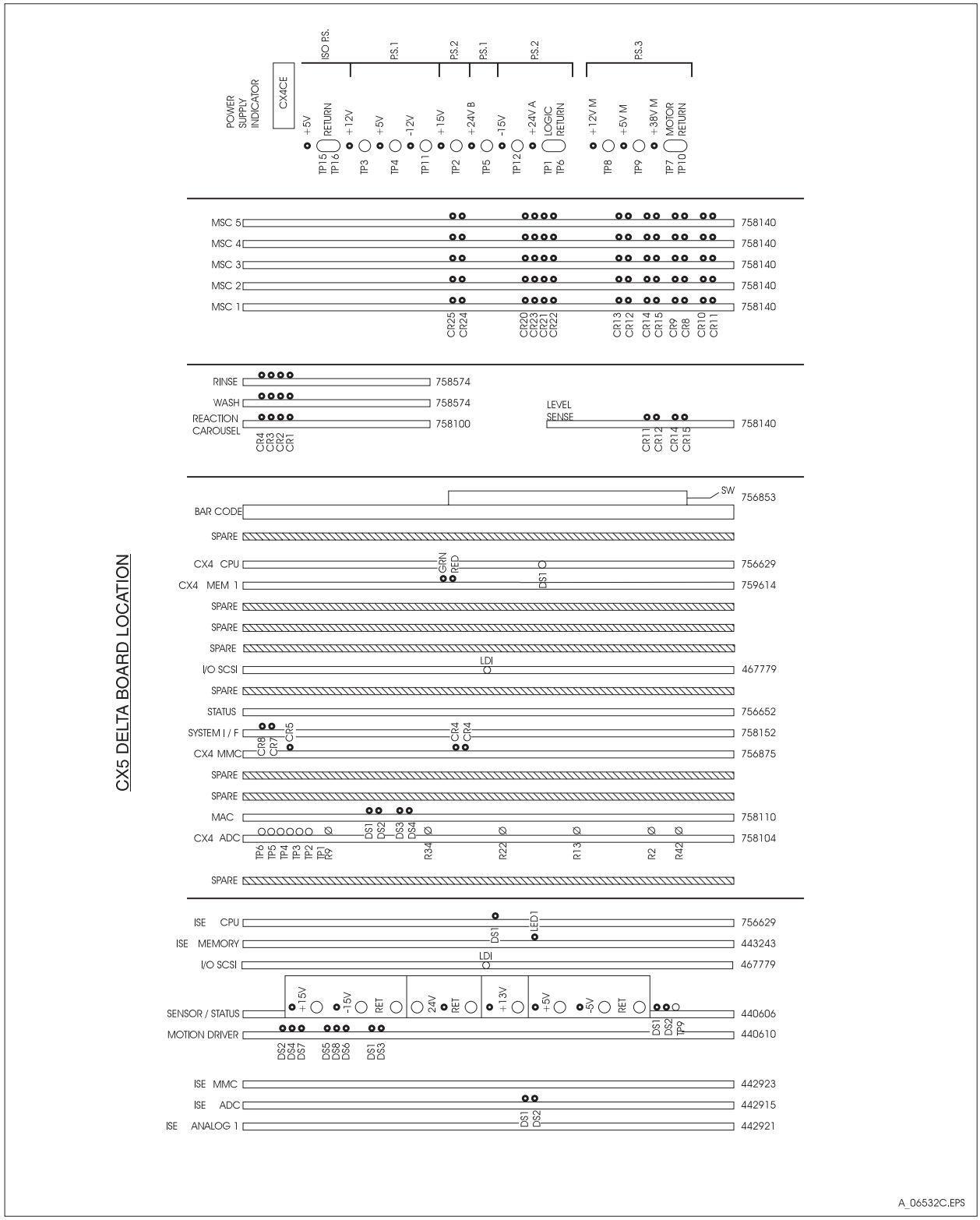

Figure C-3. CX5 DELTA Board Locations

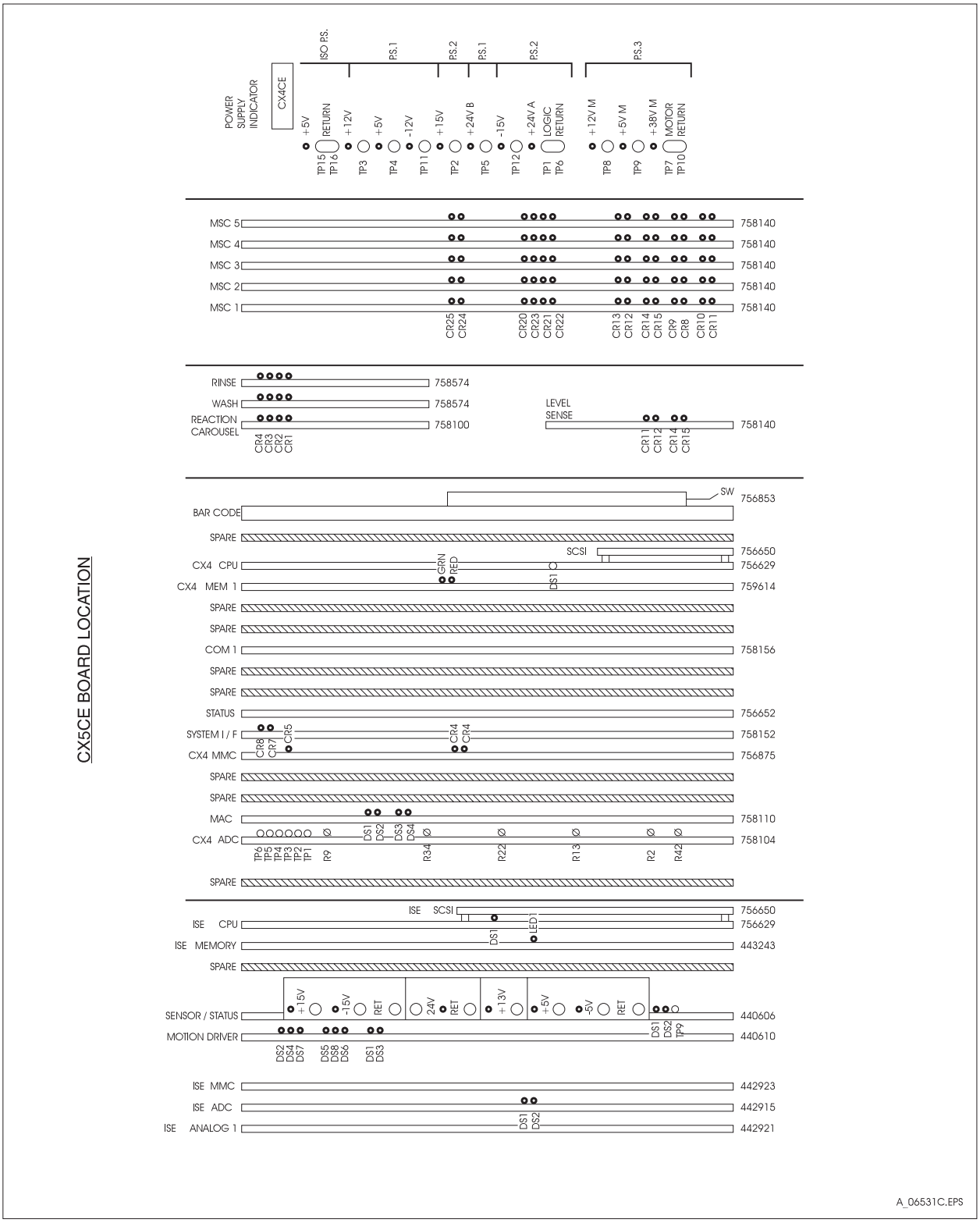

Figure C-4. CX5CE Board Locations